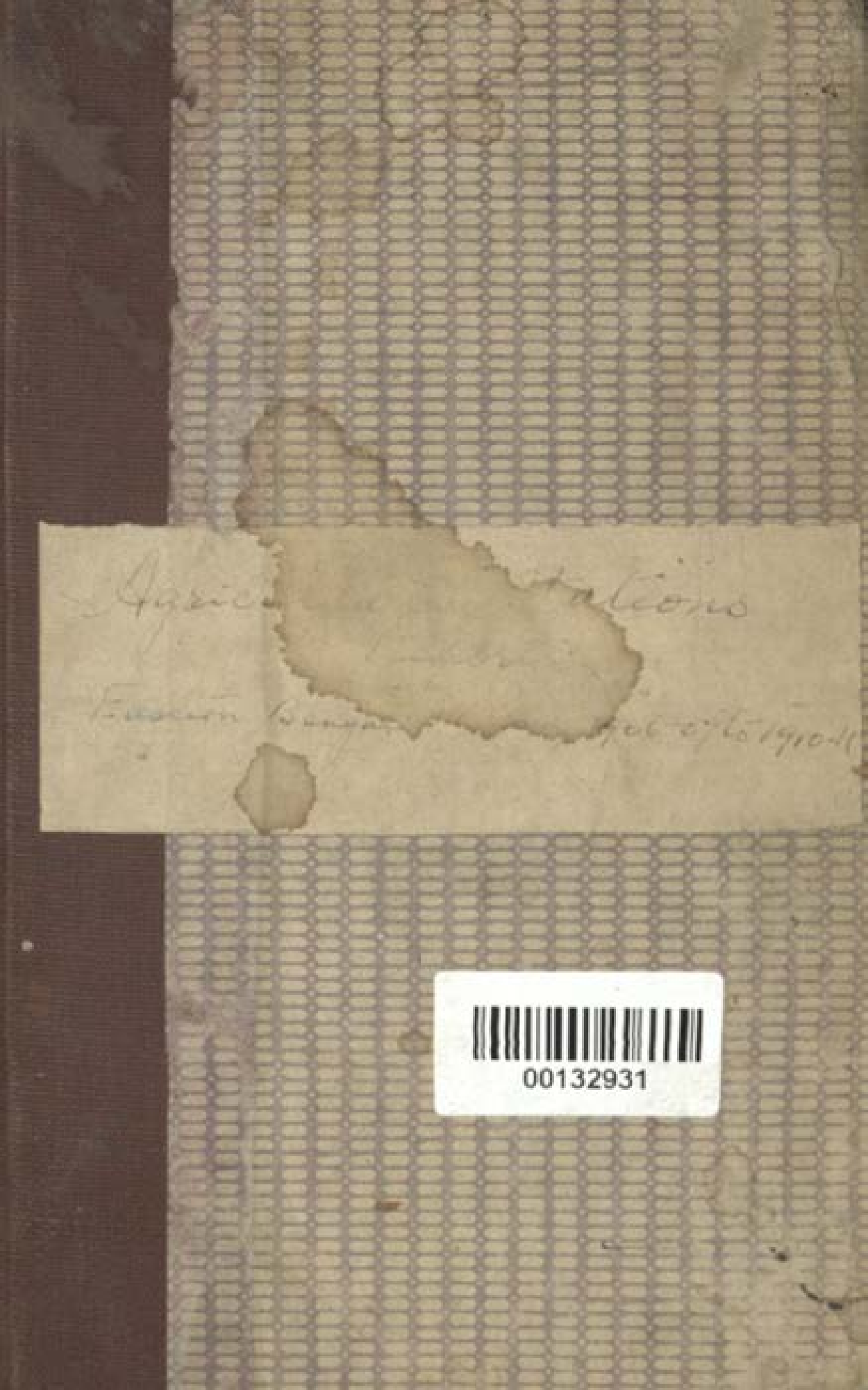
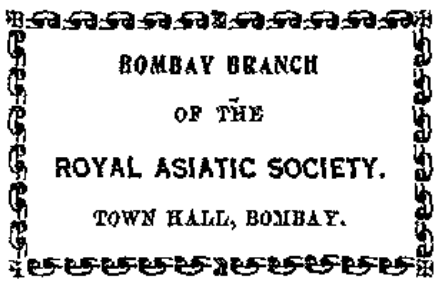

00132931



Digitized with financial assistance from
Government of Maharashtra
on 01 February, 2020

$$\frac{5}{\frac{3}{1}}$$

00132931

ANNUAL REPORT OF THE AGRICULTURAL STATIONS

IN

EASTERN BENGAL AND ASSAM

FOR THE

Year ending the 30th June 1907.

By

RAI B. C. BASU BAHADUR, B.A., M.R.A.C., M.R.A.S., (ENG.),

Assistant Director of Agriculture,

132931

ROYAL ... LIBRARY ... OF THE ...

SHILLONG:

PRINTED AT THE EASTERN BENGAL AND ASSAM SECRETARIAT PRINTING OFFICE.

1908.

Price 1 *Shilling.*] [*Price* 12 *Annas.*

Agents for the Sale of Books published by the Eastern Bengal and Assam Government.

Agents in India.

(1) Messrs. Thacker, Spink & Co., Calcutta.
(2) Messrs. W. Newman & Co., Calcutta.
(3) Messrs. S. K. Lahiri & Co., Calcutta.
(4) Messrs. A. M. and J. Ferguson, Ceylon.
(5) Messrs. R. Cambray & Co., 6, and 8/1, Hastings Street, Calcutta.
(6) Messrs. Thompson & Co., Madras.

Agents in England.

(1) Mr. E. Arnold, 41 and 43, Maddox Street, Bond Street, W., London.
(2) Messrs. Constable & Co., 16, James Street, Hay Market, W., London.
(3) Messrs. Kegan Paul, Trench, Trübner & Co., 43, Gerrard Street, Soho, W., London.
(4) Mr. B. Quaritch, 15, Piccadilly, W., London.
(5) Messrs. P. S. King & Son, 9, Bridge Street, Westminster, S.W., London.
(6) Mr. B. H. Blackwell, 50 and 51, Broad Street, Oxford.
(7) Messrs. Deighton Bell & Co, Cambridge.
(8) Messrs. Henry S. King & Co., 65, Cornhill, E. C., London.
(9) Messrs. Grindlay & Co., 54, Parliament Street, S. W., London.
(10) Mr. T. Fisher Unwin, 1, Adelphi Terrace, London, W. C.

Agents on the Continent of Europe.

(1) MM. Friedländer & Sohn, 11, Carlstrasse, Berlin.
(2) M. Otto Harrassowitz, Leipzig.
(3) M. Karl Hiersemann, Leipzig.
(4) M. Ernest Leroux, 28, Rue Bonapart, Paris.
(5) Martinus Nijhoff, The Hague.
(6) Mr. Rudolf Haupt, Halle-a.-S., Germany

SHILLONG:
PRINTED BY E. HILL, PRESS SUPERINTENDENT, E. B. & ASSAM.

CONTENTS.

ANNUAL REPORT OF THE RANGPUR AGRICULTURAL STATION.

	Pages.	Paragraphs.
History and description of the Farm; soil of the Farm; equipment.	1-4	1-5
Character of the season	4-6	6
Crops grown during 1906-1907—tobacco, ginger, potato, oats, rice, jowar, maize. Tobacco, source of seed, description of the experiments, treatment, insect and fungus pests, characters of the varieties of tobacco grown, method of growing Turkish tobacco, yield of tobacco in 1906-1907, yield of cigar leaf tobacco in 1905-1906.	6 / 6-20	7 / 8-16
Manufacture of cigars and cigarettes	20-21	17
Ginger, potato, oats, non-experimental crops.	21-22	18-19
New implements	22	20
Seed distribution	22	21
Receipts and expenditure ...	23	22
Inspection	23	23
Establishment	23	24

ANNUAL REPORT OF THE RAJSHAHI AGRICULTURAL STATION.

Introduction, history, description of soil, division into plots, drainage, fencing, buildings.	25-27	1-8
Character of the season ...	28-29	9
Experimental crops, 1906-1907 ...	29-30	10
Malancha (*Malacca capitata*) ...	30	11
Variety experiments with (1) coarse winter rice, (2) fine winter rice, (3) autumn rice, (4) sugarcane.	31-33	12-15
Manure experiments in (1) winter rice, (2) sugarcane, (3) wheat.	33-39	16-19
New implements	39	20
Seed selection with winter rice ...	39	21
Jute cultivation	39-40	22
Non-experimental crops ...	40	23
Distribution of seeds ...	41	24
Receipts and expenditure ...	41	25
Visits of inspecting officers ...	41	26
APPENDIX.—List of persons supplied with jute seed.	42	—

ANNUAL REPORT OF THE JORHAT AGRICULTURAL STATION.

	Pages.	Paragraphs.
Introduction, history and description	43	1
The soil of the Farm	43-44	3
Preparation of land for experimental cultivation.	44-45	4
Equipment	45-46	5
Character of the season... ...	46-47	6
Programme of experimental cultivation in 1906-1907.	47-48	7
Sugarcane crop of 1906-1907, insect pests, fungus disease, harvesting of sugarcane, field character of the varieties, yields of cane, juice and jaggery, quality of cane and juice, purity of juice and quality of jaggery.	48-59	8-15
Non-experimental sugar cane ...	59	16
Cost and income of sugarcane cultivation.	59-60	17
Sugarcane cultivation in current year	60-61	18
Other experiments in current year—jute, Caravonica cotton, fruit trees.	61-63	19-21
Inspection	63	22
Expenditure and income of the Farm	63	23
Establishment	64	24

ANNUAL REPORT OF THE SHILLONG FRUIT GARDEN.

Introductory, history and description of the Garden, number of fruit trees at the close of the year.	65-68	1-3
Character of the season ...	68	4
Progress of the trees—Apple, pear, plum, peach, cherry, apricot, almond, walnut, fig, grape, Spanish chestnut, chorimoyr, tree-tomato, mountain-papaya, loquat, guava, bush fruit.	69-73	5
Treatment of fruit trees ...	73	6
Battle against insects and fungus disease.	73-75	7-8
Strawberry	75-76	9
Other crops grown in the Fruit Garden—Rhubarb, asparagus, squash, sweet potato.	76-78	10
Rhubarb and asparagus demonstrations	78	11
Sericultural experiment ...	78-86	12
Silk-worm gut	86	13
Mulberry cultivation	87	14
Distribution of seeds and plants ...	87-88	15
Agricultural meeting	88-89	16
Receipts and expenditure ...	89	17
STATEMENT I.—Showing the number and description of fruit trees at the Fruit Garden and Experimental Farm.	90-111	...
„ II.—Fruits stocks at the Farm and Fruit Garden.	112	...

ANNUAL REPORT OF THE TROPICAL PLANTATION AT WAHJAIN.

	Pages.	Paragraphs
History and description ...	113	1
Soil	114-115	2
Climate	115-116	3
Character of the season ...	116	4
Work done during the year ...	116-117	5
Survey of the plantation ...	117	6
Plants under trial—Cocoa, lesser cardamom, cinnamon, nutmeg, clove, lemon-grass, camphor, greater cardamom, Natal orange, coffee, pine-apple, sapota, litchi, mango.	117-119	8
Plant diseases ...	120	9
Receipts and expenditure	120	10
Inspection... ...	120-121	11
List of plants ...	122-127	...

LIBRARY OF THE ASIATIC SOCIETY

ANNUAL REPORT OF THE UPPER SHILLONG AGRICULTURAL STATION.

Introductory, history and description	129-130	1-2
Meteorology ...	130	3
Work done during the year ...	130-131	4
Experiments with potatoes, varieties of potatoes tried, spraying with Bordeaux mixture, summer *versus* winter-seed potatoes, rapecake as a manure for potato.	131-141	5-10
Preservation of fodder in silos ...	141-142	11
Breeding of cattle and English pigs ...	142-143	12-13
Introduction of agricultural improvements.	144-145	14
Distribution of seeds and manures	145	15
Receipts and expenditure ...	145-146	16
Management	146	17

two cooly sheds on the Farm. For the curing of the crop of 1906-07 which is now being dealt with, two of the farm sheds used for the housing of coolies and cattle and a large shed kindly placed at our disposal by the Director of Land Records and the Collector of Rangpur have been used. All these sheds have iron roofing which become excessively hot during the day, causing a precipitate drying of the green leaves and preventing them from attaining a good uniform colour. Some of the sheds are open on one side and none of the others are provided with such doors and windows as would permit of the proper regulation of the temperature and humidity of the air inside the house. The curing and sweating of the tobacco has, therefore, had to be carried out under manifest disadvantages. There is every reason to hope that the quality of the leaf will greatly improve by curing and fermenting it in properly constructed sheds.

Character of the season.

6. I propose to deal in this report with the crops grown in the rainy season of 1906 and those grown in the rabi season following. It is needless, I think, to deal with the crops sown during the last quarter of the year under report which are now on the ground. These will be reported on next year. As the rains crops of 1907 depended to a great extent upon the nature of the weather during the last quarter of the previous year (April to June 1906), I have thought it necessary to include it in the following account of the character of the season. On the other hand, I consider it needless to describe the weather in May and June 1907, which could not possibly have any effect upon the crops dealt with in this report. The weather in April 1907 had an important effect upon the tobacco crop of the year and is accordingly described below.

The distribution of rainfall during the thirteen months from April 1906 to April 1907 was as follows :—

—	During the period.		Normal.	
	Rainfall. Inches.	Number of rainy days.	Rainfall. Inches.	Number of rainy days.
1	2	3	4	5
1906 April	0·34	1	3·16	4·3
„ May	11·30	16	10·37	11·1
„ June	11·14	14	19·95	15·7

	During the Period.		Normal.	
	Rainfall. Inches.	Number of rainy days.	Rainfall. Inches.	Number of rainy days.
1	2	3	4	5
1906 July	22·99	12	15·93	15·4
„ August	13·76	18	13·02	13·3
„ September	5·03	8	14·18	13·5
„ October	8·57	4	4·94	4·0
„ November	0·05	...	0·24	0·1
„ December	...	...	0·08	0·2
1907 January	...	...	0·49	0·9
„ February	0·05	...	0·43	1·1
„ March	2·63	4	1·16	1·6
Total of 1906-1907 ...	75·86	77	86·95	81·2
„ April	3·70	6	3·16	4·8

The season was unfavourable to most of the crops on the Farm. It proved almost disastrous to the tobacco crop. There was too much rain in October. It prevented sowing from being completed in due time and also retarded the preparation of land for the reception of the seedlings. Transplanting commenced in the third week of October, but further was stopped for a long time by unusual downpours at the end of that month. The bulk of the crop was planted in consequence about a month later than usual. In spite of the late planting, the crop made a good growth, and held out promise of a successful harvest, which was not, however, realised. On the 12th March came a heavy hailstorm accompanied by rain which caused great damage to the crop. A plot of tobacco grown between rows of *rahar* was entirely destroyed by the tall *rahar* plants being blown down upon the tobacco. There was another spell of heavy rain between the 16th and 22nd March which retarded the harvesting operations, already belated on account

of late transplanting, by rendering the soil excessively moist. The harvesting was resumed as soon as the soil again, became sufficiently dry but another heavy spell of rain accompanied by strong wind and hail occurring soon after on the 10th April completely ruined the whole of the tobacco crop then on the ground. About a third of the tobacco crop was harvested before the first storm of the 12th March. Of the remainder, a considerable portion was torn away by high wind and the portion which remained on the stems was gathered in, though so badly injured, as to be of little value.

The experimental ginger crop was much injured by the excessive rainfall of July which laid a portion of the land under water and caused many of the plants to perish. It caused excessive accumulation of water in some of the rice fields. A small area of rice remained submerged too long to survive. The stormy weather of March and April caused great injury to the oats and potato crops on the Farm, the first by blowing away the ripe grains and the second by beating down the crop while still green.

Crops grown during 1906-1907.

7. The crops grown during the year were as follow :—

				Acres.
Experimental.				
Tobacco	...	...	...	2·983
Ginger	...	...	...	0·225
Potato	...	...	...	0·926
Oats	...	...	...	1·550
Non-experimental.				
Rice	...	...	...	9·970
Jowar (fodder)	...	...	...	0·100
Maize (fodder)	...	...	...	0·120
	Total	...	...	15·874

Besides, the above, *rahar* was grown as a shade plant for tobacco on $\frac{1}{10}$th of an acre and cowpea as green manure for the same crop on ·15 acre.

Tobacco.

8. The following table shows the different varieties of tobacco grown and some important details in the cultivation of each.

Serial No.	Class of tobacco.	Variety.	Original source of seed.	Area in acres.	Rotation.	Manures applied per acre.	Time of planting.	Date of commencement of harvest.	Mode of harvesting.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
1	Cigar leaf tobacco.	Sumatra (sessile).	America...	·15	Fallow since October 1905.	Nil.	End of January.	.....	.....	Entirely destroyed by storm in March and April.
2		Sumatra (stalked).—								
		(i) Under straw thatch.	Ditto ...	·20	Tobacco 1906-1907. Fallow in rains of 1906.	Cowdung 75 mds; Super ½ md. Woodashes 3 mds. Saltpetre 1½ mds; and Soda water refuse 2 mds.	November (4th to 20th).	March 6th ...	Cut whole ...	The greater portion of the crop was lost through mildew, and almost the whole of the remainder through hail-storm. Only about a seer of leaf is expected to be obtained.
		(ii) Between rows of ruhar.	Ditto ...	·10	Ditto ...	Ditto ditto ...	November (15th to 23rd).	.....	.....	Entirely lost through hail-storm.
		(iii) In the sun	Ditto ...	·20	Ditto ...	Ditto ditto ...	November (6th to 20th).	January 30th...	Basal leaves plucked separately; rest cut with stem.	About a third of the crop was harvested before the storm of March 12th.
		(iv) Ditto; green manure.	Ditto ...	·15	Jowar 1905; Cowpea in rains of 1906.	Green manured with cowpea; wood ashes 3 mds; Super ½ md; Soda water refuse 2 mds.	November 25th	.....	.....	Almost wholly lost through hailstorm.
3		Havana ...	Ditto ...	·40	Tobacco 1906-1907. Fallow in rains of 1906.	Cowdung 75 mds; Super ½ md; Woodashes 3 mds; Saltpetre 1½ mds; and Soda water refuse 2 mds.	November (4th to 15th).	January 30th...	Basal leaves plucked separately; rest cut with stem.	About a third of the crop was harvested before the storm of March 12th.

Serial No.	Class of tobacco.	Variety.	Original source of seed.	Area in acres.	Rotation.	Manures applied per acre.	Time of planting.	Date of commencement of harvest.	Mode of harvesting.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
4		Connecticut seedleaf.	Ditto ...	·30	Ditto ...	Ditto ditto ...	November (5th to 20th).	February 2nd	Ditto ...	Ditto ditto.
5		Yellow prior...	Ditto ...	·30	Sugarcane 1905-1906. Fallow in rains of 1906.	Ditto ditto ...	November (4th to 11th).	,, 25th...	Ditto ...	Whole of the crop was gathered in before the storm of March 12th.
6		Virginia ...	Ditto ...	·30	Ditto ...	Ditto ditto ...	November 7th to January 17th.	January 30th	Ditto ...	About one-third of the crop was saved before the storm of March 12th.
7	Country tobacco.	Bhongi ...	Local ...	·025	Ditto ...	Ditto ditto ...	November 8th	February 28th	Ditto ...	Nearly one-forth of the crop was lost through the storm of March 12th.
8		Mana Bhongi	Ditto ...	·025	Ditto ...	Ditto ditto ...	,, ,,	April 6th ...	Cut whole ...	All plants damaged by storm of March 12th.
9		Naokhol ...	Ditto ...	·025	Ditto ...	Ditto ditto ...	,, 9th	March 28th ...	Ditto ...	Ditto ditto.
10		Sindurkhatna	Ditto ...	·025	Ditto ...	Ditto ditto ...	,, ,,	February 25th	Basal leaves plucked separately; rest cut whole.	Nearly half of the crop was lost through the storm of March 12th.
11	Cigarette tobacco.	Cavalla ...	Greece ...	·31	Tobacco 1905-1906. Fallow in rains of 1906.	Ditto ditto ...	,, 14th...	,, 16th	Primed ...	About half of the crop was harvested before the storm.
12		Scented leaf ...	Ditto ...	·20	Ditto ...	Ditto ditto ...	,, 6th...	January 26th ...	Ditto ...	About one-fourth of the crop was gathered before the storm.
13		Isabeli ...	Ditto ...	·12	Ditto ...	Ditto ditto ...	December 19th	March 1st ...	Ditto ...	Ditto ditto.
14		Sari ...	Ditto ...	·13	Ditto ...	Ditto ditto ...	November 4th	February 4th	Ditto ...	Crop on ·08 acre was wholly lost and about ⅔ths of the crop on the remainder of the area was gathered in before the storm.
15		Genita ...	Ditto ...	·013	Ditto ...	Ditto ditto ...	,, 6th	January 25th	Ditto ...	The whole of the crop was harvested before the storm, but this variety suffered from an obscure disease which has not yet been identified.
			Total area	2·983						

Source of seed.

9. The seed of Nos. 2, 3, 4, 5 and 6 was obtained during the year from Messrs. Peter Henderson & Co., of Newyork. No 2 which purported to be Sumatra tobacco was found after the plants had appeared to be very different from the varieties bearing the same name which had been grown in the previous year. It has long internodes, and the leaves are stalked, small and pendulous; while the former variety which is considered to be a true type of Sumatra tobacco has large sessile leaves set closely on the stem, and the leaves are fairly erect giving the young plants the appearance of a crown. It seems that the new variety is a freak, instances of which were noticed among the Sumatra tobacco grown in 1905-1906 and which is described in an article on the *Improvement of Tobacco by Breeding and Selection* which appeared in the Year Book of the Department of Agriculture, United States of America, for 1904. The variety is of a decidedly inferior quality.

Fresh seed of the varieties numbered 11 to 15 was obtained during the year from Greece through the British Consul at Athens. Varieties Nos. 11 to 14 had been cultivated in the previous year, and some seed saved from the crop of that year was used last year in addition to the seed procured anew from Greece.

Description of the tobacco experiments.

10. There were six different experiments with tobacco undertaken during the year. These were :—

(1) *To grow wrapper leaf under shade.*—Two kinds of shade were tried, *viz.* (1) under a light thatch of grass spread over a bamboo frame work some 8 feet about the ground, and (2) by growing the tobacco between rows of *rahar* plants. The variety grown in this experiment was the newly imported Sumatra which as stated above turned out to be a very inferior sort.

(2) *To grow wrapper leaf in the sun.*—The variety grown for this purpose was the new type of Sumatra imported last year, but when it was found to be of very inferior quality a small area was planted with Sumatra of the older sessile type. It is also expected that some of the leaf grown for filler (experiment 3) may turn out to be of a quality suitable for use as wrapper.

(3) *To grow leaf suitable for fillers.*—The varieties grown for this purpose were Sumatra, both of the old sessile and the new stalked type, and the American tobaccos numbered 3 to 6 in the foregoing table, *viz.*, Havana, Connecticut seed leaf, Yellow prior and Virginia.

(4) *To grow some of the best known varieties of Rangpur tobacco for the purpose of comparison with the imported kinds and to study their field characters.*

(5) *To grow tobacco suitable for the manufacture of cigarettes.*—This experiment has been made hitherto only with Grecian tobacco which may more appropriately be spoken of as Turkish tobacco. The country varieties have been considered too coarse and strong for the manufacture of any but the cheapest cigarettes for local consumption.

(6) *To see whether green manuring with cowpea will supply enough nitrogen to the soil to render the use of cowdung or any other nitrogenous manure unnecessary.*

Treatment of the tobacco.

11. Some details of cultivation have been mentioned in the table given above. The land was reduced to a fine tilth before planting and the ground between the plants kept free of weeds and in a loose friable condition by frequent interculture.

The manures used were for the most part applied some time before the plants were set out in the field; a part of the saltpetre and wood ashes was used as a top dressing. In the case of the plot manured with cowpea the green stuff was ploughed in in the beginning of August, some $3\frac{1}{2}$ months before the time of transplanting the tobacco; the cowpea had grown well and produced a dense mass of vegetable matter which rotted readily in the soil.

The cigarette tobaccos which have comparatively smaller leaves were planted two feet apart between the rows and one foot apart in the rows. The other varieties were spaced $3' \times 1'$.

The cigarette tobaccos were topped, but the suckers were only partially removed. It was feared that the removal of all the suckers would cause the leaves to become too thick, large and coarse to suit the manufacture of cigarettes. The cigar-leaf and country varieties were topped and suckered as usual.

The straw thatch placed over the tobacco in the first experiment was put up soon after the crop had been transplanted. The cost of the thatch came to Rs. 59-3-0 for $\frac{1}{5}$th of an acre.

The second method of shading the tobacco consisted, as already stated, in growing it between rows of *rahar* trees. The *rahar* was sown in lines 9 feet apart in the preceding April and by the time the tobacco was ready for transplanting, the trees had grown 8 to 10 feet high so as to shade the intervening grond during the greater part of the day. Between every two rows of *rahar* three lines of tobacco, 3 feet apart, were put down.

The cigarette tobaccos were harvested by priming, that is, by plucking the individual leaves as they became ripe. The priming was done in accordance with instructions received from the British Consul at Athens. With the cigar-leaf tobaccos a different course had to be followed. The priming was limited to 2 to 4 leaves at the base which ripened first; the rest of the leaves were gathered along with the stem when they were more or less ripe. The object of retaining the stem is to utilise its moisture as a check upon the leaves getting dry too quickly.

The curing of the tobacco was done, as in the previous year, entirely in the shade. As already stated, the sheds used for curing were improvised structures destitute of any means for regulating the temperature and humidity of the air inside. The subsequent process of fermentation or sweating is being carried out in the same sheds. This process is not yet completed for the cigar-leaf and country tobaccos which still remain in bulk. The cigarette tobaccos have undergone the slight fermentation they needed.

Insect and fungous pests on tobacco.

12. As in the previous year the crop grown in the shade was attacked by a species of mildew, known to science as *Erysiphe cichoracearum*. It appeared both in the crop grown under thatch and in that grown between *rahar* trees. It was also observed in a patch of tobacco grown in the open, but adjoining one of the shade-grown plots. Experience in the previous year had indicated a remedy for the evil. It consists in removing the shade as soon as the disease appears. The grass thatch over one of the shaded plots was accordingly removed as soon as symptoms of the disease were observed.

The matter was of some difficulty in the case of the *rahar* shaded tobacco, as the shade could not be removed without cutting down the *rahar* trees which promised a good outturn of pulse. The dilemma was, however, solved for us by the heavy storm of March 12th which destroyed the *rahar* and the tobacco crop alike.

The *Genitz* variety of tobacco was badly affected by an obscure disease. A specimen of an affected planty was submitted to the Imperial Mycologist for identification of the disease and advice. Dr. Butler thought that the disease was due either to want of potash in the soil or to its being one of the forms of the "Mosaic" disease, the cause of which is uncertain. The soil of the Farm judging from the analysis quoted in this report appears to be rich in potash, and the land had been manured for two years in succession with fairly heavy doses of nitrate of potash and wood-ashes. The disease could not therefore be due to want of potash in the soil. Dr. Butler advised that all diseased plants should be pulled up and destroyed. His advice will borne be in mind.

Cut-worms were the only insect pest that affected the tobacco crop during the year. They were not so troublesome as in the previous year, except in the plot green-manured with cowpea where they did considerable injury by cutting down the young plants. Dipping the seedlings in a mixture of lead arseniate and water (1 to 320) was tried, but failed to check the pest. Poisoned baits made of Paris green, jaggerry and pulse husks in the porportion of 1:4:80 were used later on, but seemingly to no effect. The only way left to deal with the pest was hand-picking which was persistently practised until the insects ceased to cause trouble; but by that time more than half the plants had been destroyed.

Characters of the varieties of tobacco grown.

13. The characters of each of the varieties of tobacco under trial while growing in the field as well as of the cured leaf were noted by the Superintendent of the Farm. I was able to help him to some extent in this work. These notes are embodied in the table given below.

TABLES.

Tables showing the characters of the varieties of tobacco grown in 1906-1907.

Variety.	Green leaf.				Growth, heavy or light; number of leaves kept.	Cured leaf.				Remarks.
	Length of lamina.	Width of lamina.	Length of stalk, if any.	Shape, appearance, and disposition of leaves.		Thickness.	Venation.	Gum.	Colour and texture of leaf.	
1	2	3	4	5	6	7	8	9	10	11
Cigar leaf—	Inchs.	Inches.								
1. Sumatra (sessile).	22—27	10—14	Sessile ...	Oval with pointed tip and amplexicaul base; leaves closely set on stem, erect giving young plants a crown-like shape.	Very heavy; 20 to 23 leaves.	Thin ...	Veins in top part rather fine, but in lower part somewhat coarse; veins do not get same colour as rest of leaf which is a defect.	Normal ...	Thin, silky and strong; suitable for wrappers as well as fillers; seems best of all in spite of defect in venation.	Second generation from seed imported from America in 1905.
2. Sumatra (stalked).										
(i) Grown in shade.	15—19	8—12	3 inches, clean	Oval with pointed tip; peculiarly pendulous; stalks bending downwards; long internodes giving the plant a lean lanky appearance.	Very light; 14 to 16 leaves.	Thin ...	Fine ...	Less than normal.	Dull yellow colour. Somewhat silky.	Most of the leaves were spoiled by mildew or by storm variety evidently a freak; very inferior on the whole.
(ii) Grown outside.	16—17	8—10	Ditto ...	Ditto ...	Ditto ...	Thick ...	Coarse ...	More than normal.	Dull yellow colour; well spotted showing strength. May do for fillers.	Same as 2(i) as regards type of tobacco.

3. Havana ..	Inches. 15—17	Inches. 6—10	Sessile ...	Elongated, narrow with amplexicaul base; erect; internodes fairly long; tip less pointed than No. 4.	Light; 15 to 17 leaves.	Thick ...	Coarse ...	More than normal.	Dark; well spotted; may do for fillers; may make mild Burma cheroots.	
4. Connecticut seed leaf.	22—24	Ditto..	Ditto ...	Elongated, narrow with long pointed tip; erect; short internodes like those of *No.* 1.	Light; 10 to 11 leaves.	Rather thin	Rather fine ...	Normal ...	Good colour and texture; well spotted showing strength; next in point of quality to No. 1 for making wrappers and fillers.	
5. Yellow prior	18—20	6—10	Ditto ...	Elongated, narrow with long pointed tip; arching; internodes of medium length.	Light ...	Ditto ...	Ditto ...	Ditto ...	Yellow slightly spotted; may do for wrappers as well as fillers.	
6. Virginia ...	Ditto...	Ditto...	Ditto ...	Ditto ...	Ditto ...	Thick ...	Coarse ...	More than normal.	Colour darker than No. 5; too coarse for wrappers; may do for fillers.	
Country tobacco—										
7. Bhongi ...	18—19	14—15	3" with leafy growth at the base.	Heart shaped with pointed tip; arching; internodes of medium length.	Heavy ...	Thin ...	Fine ...	Less than normal.	Dull yellow; thin but wanting in texture; *few* spots.	
8. Mana Bhongi	18—21	12—15	3" with leafy growth at base.	Longer but narrower and tip more elongated than No. 7; arching; long internodes.	Ditto ...	Thick ...	Coarse ...	More than normal.	Ditto ...	Mana Bhongi is only another form of Bhongi. Mana means long and narrow.
9. Naokhol ...	21—25	12—14	3" with leafy growth at base.	Elongated; narrow; boat-shaped whence the name; arching; long internodes; elongated tip.	Very heavy ...	Thin, though appeared thick while growing.	Coarse ...	Normal ...	Resembles No. 1 in colour and texture; may be used as wrappers as well as fillers.	

Tables showing the characters of the varieties of tobacco grown in 1906-1907—concluded.

Variety.	Green leaf.				Growth, heavy or light, number.	Cured leaf.				Remarks.
	Length of lamina.	Width of lamina.	Length of stalk, if any.	Shape, appearance and disposition of leaves.		Thickness.	Venation.	Gum.	Colour and texture of leaf.	
1	2	3	4	5	6	7	8	9	10	11
	Inches.	Inches.								
10. Sindur Khatun.	14—18	9—11	2' with leafy growth as above.	Oval with pointed tip; arching; long internodes.	Lighter than Nos. 7, 8 or 9, but heavier than Nos. 3 or 4.	Thin ...	Fine ...	Less than normal.	Red copper colour, quality uncertain.	
Cigarette tobacco (Turkish).—										
11. Cavalla ...	6"—9	4—5	Sessile ...	Oval with roundel tip; smallest in size of all the varieties grown; erect; long internodes.	Light ...	Thin ...	Fine; side ribs spring nearly at right angle to midrib and then curve towards the tip.	Normal ...	Light yellow colour; well spotted; good texture; best of the 5 Turkish varieties for making cigarettes.	
12. Scented leaf.	10—12	6—8	2' clean ...	Oval with pointed tip; erect looking like rosette.	Very heavy for cigarette tobacco.	Ditto ...	Fine ...	Ditto ...	Light yellow colour; neat in point of quality to Cavalla.	Is stalked which is a defect.
13. Isabeli ..	12—15	6—7	Sessile ...	Elongated; narrow with pointed tip; erect.	Lightest and smallest of all.	Rather thick	Coarse ...	Ditto ...	Fairly yellow colour; woolly; silky texture.	Corrugated inflorescence.
14. Sari ...	14—20	Di to ..	Ditto ...	Elongated with pointed tip; erect.	Fairly heavy ..	Thin ...	Ditto ...	Ditto ...	Ditto ...	Ditto.
15. Geniz ...	10—12	6—8	1½ clean ...	Oval with pointed tip; erect.	Light ...	Ditto ..	Fine ...	Less than normal.	Dark greenish yellow colour; few spots.	The crop was attacked with an obscure form of disease which necessitated early pulling. The leaf therefore did not colour properly.

Many of the characters noted in the foregoing table are such as can be greatly modified by varying the system of cultivation and curing, and are to be regarded as of a comparative nature as between the varieties in the same class. This remark does not apply of course to such characters as appertain to the morphology of the plaint, *e.g.*, shape of leaf existence or absence of petiole, rounded or pointed apex, etc. These cannot be altered by cultivation.

It is proposed to submit samples of the cured leaf for report to an expert, and until his report is obtained, it would be unwise to express any definite opinion as to the quality of the leaf either for manufacturing cigars or cigarettes. So much may, however, be said in this connection that cigars as well as cigarettes of fair quality have been made out of tobacco grown at Rangpur in 1905-06, most of the varieties cultivated in that year being identical with varieties grown in the year under report. It is also to be remembered that the tobacco hitherto grown on the Farm could not be properly cured and sweated for want of a suitable curing house, and there is every reason to hope that the quality of the tobacco, particularly the heavier cigar leaf kinds, will improve, once such a house has been provided.

Method of growing Turkish tobacco.

14. The methods of cultivation and curing followed by the Turkish cultivators appear to me to be very different from those we have hitherto followed in growing Turkish cigarette tobacco at Rangpur. Recently we have received through the courtesy of the British Consul-General at Constantinople some specimens of high-class cigarette tobacco grown in Turkey. The most striking features of these specimens are the extremely (almost ridiculously) small size and the bright golden colour of the leaf, not to speak of the strong, but sweet aroma which it emits. The largest leaf in the specimen would not be more than 1″×3″ and the smallest might not be larger than 1½″×1″. The object of the Turkish tobacco growers, at all events of the kinds most in repute, is to produce a small thin leaf which would mature quickly and take a bright colour. They attain this end by deliberately adopting those very methods which would be deprecated elsewhere as being calculated to check and dwarf the growth of the plant. They choose a dry sandy soil for the cultivation and seldom use any manure other than what can be obtained by folding goats and sheep on the land. Farm-yard manure is used only at long intervals. The plants are set very closely together

in the field seldom exceeding 12″×8″ and often much closer so as to reduce the size of the leaves. Very little interculture is done. Topping, though practised in some places, is not the general rule and suckering is never done. The crop is never irrigated. These methods are radically different from the system pursued in Rangpur and most other places, I believe, where tobacco is grown. In regard to curing also, our method has not been the same as that followed in Turkey. There, tobacco is cured in the sun, while our cigarette tobacco was cured in the shade.

The cigaratte tobacco produced in the Rangpur Farm is very unlike the specimens received from Turkey. The leaves are several times the size of the largest leaf in these specimens and they lack the bright yellow colour so characteristic of Turkish tobacco. The farm tobacco has a mild pleasant aroma, but much less pronounced than in Turkish. I do not know if by following the Turkish methods at Rangpur we should be able to grow tobacco which, though it may not equal Turkish tobacco, may yet approach it sufficiently near to rank as a first-class cigarette leaf. Anyhow, the Turkish method of cultivation deserves a careful trial. I intend to take it up next year at the farm at Burirhat.

Yield of tobacco in 1906-07.

15. The cigar leaf and country tobaccos are still in bulk. The yield of these varieties cannot be ascertained for some time yet and will be reported in the next annual report. The yields of the Turkish varieties were as below :—

Variety.	Area in acres.	Quality.	Actual yield.			Total yield per Acre.		
1	2	3	4			5		
		No.	Mds.	srs.	ch.	Mds.	srs.	ch.
Cavalla	·31	1	0	31	12			
		2	1	1	8			
Total ...			1	33	4	6	22	2
Scented leaf	·20	1	0	16	4			
		2	0	3	4			
Total ...			0	19	8	2	17	8

Variety.	Area in Acres.	Quality.	Actual yield.			Total yeild per acre.		
1	2	3	4			5		
		No.	Mds.	srs.	ch.	Mds.	srs.	ch.
Isabeli	·12	1	0	8	0			
		2	0	6	0			
Total ...			0	14	0	2	36	11
Sari	·13	1	0	32	8			
		2	0	12	0			
Total ...			1	4	8	8	22	5
Genitz	·013	1	0	5	0			
		2	0	1	8			
Total ...			0	6	8	12	20	0

Yield of cigar-leaf tobacco in 1905-06.

16. The sweating process for the cigar leaf tobaccos grown in 1905-06 had not been completed at the time of my last annual report, and consequently the yields of those tobaccos could not be reported at the time. The leaf was weighed at the end of the sweating process. The weights obtained were as follows :—

Variety.	Area in acres.	Quality.	Actual yield.			Yield per acre.		
1	2	3	4			5		
			Mds.	srs.	ch.	Mds.	srs.	ch.
1. Sumatra—								
(i) Grown under shade	0·68	No. 1	0	5	0			
		„ 2	0	20	0			
		„ 3	0	2	0			
		Imperfectly cured leaf.	2	28	0			
		Total ...	3	15	0	4	38	8
(ii) Grown in the sun	0·32	No. 1	0	30	0			
		„ 2	1	10	0			
		„ 3	1	23	0			
		Total ...	3	23	0	11	6	14
2. Virginia	·03		0	5	0	4	6	11
3. Maryland	·05		0	14	0	7	0	0

Samples of these and the cigarette tobaccos grown in 1905-06 have been sent to the Director-General of Commercial Intelligence to have them appraised by an expert. The report of the expert is being awaited.

Manufacture of cigars and cigarettes.

17. A professional cigar-roller from Dindigul in Madras has been employed on the Farm since August 1905. His duty is to manufacture cigars out of the tobacco grown on the Farm. Last year, the manufacture of cigarettes in addition to cigars was begun. These manufactures are intended solely to test the quality of the various grades of tobacco produced on the Farm. I am glad to be able to say that our cigars and cigarettes continue to be well spoken of by both European and Indian smokers. I should not omit to mention that complaints about the quality of the cigars have occasionally been received. Some of the cigars have been found not to draw well. This defect was evidently due to bad rolling; there is little doubt left as to the good quality of the leaf itself. The cigar-leaf tobaccos have been found to burn well, to possess a fair aroma and a mild flavour, and to be devoid of any bitter or unpleasant taste. Our cigarette tobaccos too have attracted favourable attention. The cigarettes burn well, have a sweet and mild fragrance, not so well pronounced as in Turkish tobacco, but distinctly better than in any of the commoner brands on the market, and afford altogether an agreeable smoke.

The quantity of cigars and cigarettes made during the year under report was as follows:—

	Number.
Cigars	9,868
Cigarettes	2,112

The amount realised from the sale of cigars and cigarettes amounted to Rs. 86-15-6. Four principal qualities of cigars are made on the Farm. These are (1) Swadeshi No. 1, torpedo-shaped, 4½ inches long, Rs. 2-8 per 100; (2) Swadeshi No. 2, torpedo shaped, 4 inches long, Rs. 2 per 100; (3) Swadeshi No. 3, 3½ inches long, Rs. 1-8 per 100; and (4) Manilla shaped 3½ inches long, annas 12 per 100. The qualities mentioned above are made out of Sumatra tobacco grown in the sun, blended more or less with the cigar leaf tobaccos produced in the Farm. A special quality of cigars was made in small quantities in which the wrapper consisted of the best shade-grown Sumatra leaf produced in 1905-06. These were priced 8 annas more per 100 than

the corresponding qualities in which sun-grown Sumatra leaf was used as wrapper. Our cigarettes which are about the size of the commoner brands of Egyptian cigarette are sold at 2½ annas per packet of 10. They are entirely hand-made. The leaf is cut by a hand-chopper and the rolling is done by a tiny hand machine known as the "Conconium."

Other experimental Crops.

18. *Ginger.*—Four varieties of ginger—Jamaica, Cochin, Calicut and country—have been under trial since 1905-06. The experimental cultivation of the year under report was a failure owing partly to the excessive rainfall in July which swamped and destroyed a part of the crop and partly to the unsuitable character of the land in which the ginger was planted. The trials are being repeated in the current year.

Potato.—Three varieties of potato were tried—Nainital, Patna and Flower Ball. This experiment too proved indecisive. The crop could not be planted in consequence of the late arrival of seed till after the proper season for planting had almost passed, and the crop was destroyed before it had time to mature by the disastrous storm of March 12th. The three varieties gave the following yields per acre :—

— —	Area in acres.	Actual yield.		Yield per acre.	
1	2	3		4	
		Mds.	Srs.	Mds.	Srs.
Nainital	·05	5	25	112	20
Patna	·05	1	19	29	20
Flower Ball	·037	0	13½	6	30

The yields cannot for the reasons stated above be compared *inter se* with strict accuracy, but the figures will, I think, show the superior productiveness of the Nainital variety which, in spite of the adverse condition of the season and the late planting, yielded a fair outturn.

Oats.—A crop new to the district. The crop did not grow so well as in the previous year, but a fair outturn would havy been secured but for the storm of 12th March which greatle

damaged the crop. The yield eventually obtained amounted to 6 mds. 33 seers from an area of 1·55 acres equivalent to 4 mds. 35 seers per acre.

Non-experimental crops.

19. The non-experimental crops were winter rice on 9·97 acres, *jowar* on one-tenth of an acre, and maize on ·12 acres. The last two crops were grown for fodder and fed green to cattle. Their yields were not recorded. The outturn of winter rice amounted to 187 mds. 15 seers from 9·97 acres equivalent to a yield of 18 mds. 32 seers per acre. The great bulk of the crop (112 mds. 5 seers.) consisted of a fine variety of rice known as *Kataribhog* imported in 1905 from Dinajpur. The rate of yield of this variety was 20 mds. 30 seers per acre. The yield of a coarser variety of indigenous rice known as *Joshoa* grown in adjacent land amounted 54 mds. 15 seers from an area of 2·13 acres, the acreage yield being 24 mds. 9 seers, which is nearly 3½ mds. more than that of the *Kataribhog* variety. The latter therefore does not seem to possess any superiority over the former except that it ranks among the very finest kinds of rice known in Eastern Bengal. At Rangpur, however, there is little demand for fine paddy and the farm stock of *Kataribhog* paddy had to be sold at almost the same price as the coarser kind.

New implements.

20. The new implements used during the year were a Planet Junior hand-hoe and a Hindustan plough. The Planet Junior hand-hoe continued to do good work and found useful for interculture between the rows of the maize crop. The Hindustan plough was regularly used, but the share became worn out after being used for 8 or 9 months and needs to be replaced. The implement was purchased from Messrs. Jessop Co. and cost Rs. 14. It is strange that the share should wear out so quickly. The sandy character of the soil may be responsible for the result. This plough has been very favourably reported on by the Superintendent of the Rajshahi Farm, and it is a matter for surprise that the experience of the two farms should disagree.

Seed-distribution.

21. The following quantities of seed were supplied by the Farm during the period under report :—

Tobacco seed—	
Exotic varieties	26 ounces.
Country	9¾ ,,
Kataribhog paddy seed	5 seers.

22. The receipts of the Farm for the year under report amounted to Rs. 840-3-9, and the expenditure to Rs. 5,087-14-5. The latter included a sum of Rs. 631-10-2 for capital charges and Rs. 2,100-0-6 for pay and travelling allowance of establishment.

Receipts and expenditure.

23. His Honour the Lieutenant-Governor accompanied by the Chief Secretary, Hon'ble Mr. LeMesurier, the Commissioner Mr. Fischer, and the Director of Public Instruction Mr. Sharp, paid a visit to the Farm on the 27th February 1907. The Farm received frequent visits from the Collector. The Officiating Commissioner Mr. F. C. Henniker visited the Farm in May last.

Inspection.

The Farm was inspected by Mr. H. C. Barnes, Director of Land Records and Agriculture, in July, and by his successors Mr. N. D. Beatson-Bell in November and by Mr. S. G. Hart, Director of Agriculture, in March last. I visited the Farm five times during the year.

24. The establishment of the Farm consists of a Superintendent on Rs. 100-10-200, a fieldman clerk on Rs. 25—1-8—40, and a peon on Rs. 8. The appointment of a fieldman clerk was filled up in March last. Besides this establishment there is sanction for the entertainment of two fieldmen apprentices on Rs. 15 per month. One of the two appointments was filled up in March last and the other remains vacant. The cigar-roller employed on the Farm belonged till lately to the establishment of the Technical School and was paid by the Education Department. His services have been recently transferred to this Department.

Establishment.

Shillong, B. C. BASU,

The 15th July 1907. *Assistant Director of Agriculture.*

ANNUAL REPORT OF THE RAJSHAHI AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1907.

Introduction.

THE present report deals mainly with the crops grown during the second year of its existence, namely during the agricultural season which covered the rains of 1906 and the cold weather of 1906-1907. The year under report covers also the first quarter of the current Bhadoi season, but the crops now on the ground are all immature and are not dealt with in this report.

History.

2. The Rajshahi Farm was created in November 1904. The Farm is situated very close to the Rampur Boalia town, the headquarters of the Rajshahi district. It covers an area of 63 acres, out of which about 50 acres is available for cultivation, the rest being occupied by sites for houses, roads, drains and a small jheel at the northwestern corner of the Farm. The land, though it has been in the possession of Government for over two years, still remains the property of the Rajshahi Association. The Association has all along proposed to transfer the land to Government by a formal deed of transfer, but for some reason or other the formal transfer has not yet taken place. In view of the great delay that has occurred, it is proposed now to acquire the land for Government under the Land Acquisition Act.

Description of soil.

3. About one-half of the area of the Farm is low land with a dark clay soil, and is well suited for the cultivation of winter rice and jute. The rest of the area is high land with a lighter soil, and suited for jute and the usual dry crops of the country. The land has been long under cultivation, and a small *basti* stood in the south-east corner of the Farm at the time the land was taken up for the Farm.

4. Seven samples of soil taken from different parts of the Farm were analysed during the year by Dr. Leather.

Imperial Agricultural Chemist, whose report on the composition of the samples is reproduced below :—

Average sample of all the seven—

Insoluble silicates and sand	77·90
Ferric oxide	4·56
Alumina	6·15
Lime	3·29
Magnesia	1 37
Potash	·65
Soda	·21
Phosphoric acid	·11
Sulphuric acid	·03
Carbonic acid	2·34
Organic matter and combined matter ...	3·39
Total	100·00

—	196-07. Plot No. 3.	197-07. Plot No. 37.	198-07. Plot No. 61.	199-07. Plot No. 83.	200-07. Plot No. 110.	201-07. Plot No. 116.	202-07. Plot No. 120.
1	2	3	4	5	6	7	8
Organic carbon	·616	·533	·644	·806	·734	·508	·4·4
„ nitrogen ...	·054	·095	·065	·089	·081	·059	·043
Calcium carbonate ...	5·4 0	2·910	3·590	6·360	4·600	6·049	6·322
Total phosphoric acid ...	·085	·069	·051	·146	·109	·042	·100
Available phosphoric acid...	·0034	·011	·003	·059	·005	·003	·003
Available potash ...	·010	·009	·004	.011	·001	·001	·001

Excepting plot No. 83, these soils are characterised by a deficiency of phosphates and potash; plot No. 83 is better off, more especially in the matter of phosphate. The amount of organic matter is low, but not lower than the Indian alluvial soils generally. There is abundance of carbonate of lime.

Division into plots.

5. The Farm which is in the shape of an oblong, is divided by two main roads into four rectangular blocks, and is enclosed with another road running along its boundaries. Two out of the four blocks

have been laid out in plots of uniform size, each $\frac{1}{8}$th of an acre, and the greater part of another into plots of $1\frac{1}{5}$th of an acre each. The fourth block and the remainder of the third will be now being laid out into plots of regular size. Much levelling work had to be done, particularly in the block on the south-east of the Farm to reduce the inequalities of the surface.

Drainage.

6. The Farm is served by a large number of open drains, but owing to the absence of a proper outlet, a considerable area in the northern part of the Farm remains water-logged during the rainy season. This defect can be remedied to a great extent by re-excavating a large drain which was made many years ago by the District Board, but which unfortunately has been allowed to get silted up. The attention of the Chairman of the District Board has been invited to the matter, and it is hoped the work of re-excavation will be taken in hand in the next cold weather. The Farm is subject to the inroads of water from the Ganges when in high flood, but no injury has resulted so far from this source. In fact, last year, the Ganges water was found helpful for transplanting winter rice. The open drains in the Farm have been provided recently with masonry culverts at the several points at which they intersect the roads.

Fencing.

7. The Farm is enclosed with a wire fence, but unfortunately it is not sufficiently strong to keep out cattle, and the wires being placed too wide apart afford no protection whatever against goats. The Farm has greatly suffered also from the depredations of wild pigs. The experimental sugarcane and *aus* rice crops of last year were injured by wild pigs to such an extent as to cause a failure of the experiments. Several other crops suffered more or less from the same pest. Until the Farm is sufficiently protected from the ravages of cattle and wild pigs, the successful prosecution of experiments with such crops as sugarcane and rice will continue to be well-nigh impossible.

Buildings.

8. There is no permanent building as yet on the Farm. The construction of buildings has had to be postponed pending the acquisition by Government of a legal title to the land. Much inconvenience is being experienced for want of a properly constructed cattle shed and of a godown for the storing of seeds and other perishable goods.

Character of the season.

9. The following statement exhibits the rainfall of the season under report, side by the side, with the normal rainfall. :—

Month.	1906-1907.		Normal.	
	Rainfall inches.	Number of rainy days.	Rainfall inches.	Number of rainy days.
1	2	3	4	5
1906.				
April	...	...	1·31	2·9
May	2·40	6	5·56	7·7
June	7·99	10	10·81	12·6
July	8·20	14	11·45	15·1
August	16·11	19	10·75	14·7
September	9·73	14	10·40	12·4
October	4·26	6	4·46	4·9
November	3·43	1	0·31	0·6
December	...	...	0·06	02
1907.				
January	...	...	0·34	0·8
February	0·69	3	0·84	1·3
March	1·88	5	1·15	1·6
Total	54·69	78	57·94	74·8

The total rainfall of the year was not far removed from the normal, but it was badly distributed in the two important periods of the year. There was an unusually long drought in April and the early part of May which prevented the *bhadoi* crops (jute and *aus* rice) from being sown in due time. The rainfall conditions were exactly the reverse in the season for the sowing of cold weather crops. There was an unusually heavy down-pour at the end of October and the first day of November which interfered seriously with

the preparation of the land and greatly retarded the sowing operations. There was want of sufficient rain in July for the transplanting of winter rice, but it was compensated for by abundance of flood water from the Ganges. The distribution of rain during the remainder of the year was all that could be desired.

There was an outbreak of rinderpest among the Farm cattle in August last. On the appearance of disease all the cattle were inoculated with anti-rinderpest serum. Inspite of the precaution, every animal was attacked, though fortunately only one out of the 20 work cattle succumbed to the disease. The rest recovered within a month. The outbreak interfered much with the preparation of land for the *rabi* crops.

Experimental crops, 1906-1907.

10. The programme of experiments in 1906-1907 included—

I.—NEW CROPS—

(1) Potato, a crop new to the locality, to be grown without irrigation.

(2) *Malancha.*—(*Malacra capitata*).—A new fibre.

II.—VARIETY EXPERIMENTS WITH—

(1) Coarse winter rice.

(2) Fine winter rice.

(3) Autumn rice.

(4) Sugarcane.

(5) Wheat.

III.—MANURE EXPERIMENTS IN—

(1) Winter rice.

(2) Sugarcane.

(3) Wheat.

IV.—TRIALS OF NEW IMPLEMENTS.

V.—SEED SELECTION WITH—

(1) Local variety of coarse winter rice.

(2) Local variety of fine winter rice.

VI.—JUTE CULTIVATION.

Out of these experiments proposed, the following could not be made for the reasons mentioned against them.

I (1) *Potato.*—For want of seed. Seed potatoes were despatched from Shillong at the end of September, but owing to the negligence of the carrying agents they did not reach Rajshahi till long after the season for planting potato had passed.

II (4) Variety experiment with sugarcane. Had to be abandoned partly in consequence of the late arrival of seed cuttings from Bengal and partly owing to a mistake made by the then Superintendent of the Farm in planting out the varieties. The only new variety planted was Dacca Ganderi, and although it was not planted side by side with local cane for comparison, the yield it gave was so extraordinarily heavy as to deserve mention

II (5) Variety experiment with wheat.—This could not be carried out for want of seed. Muzaffarnagar wheat was to have been contrasted with local wheat. The seed was despatched from the United Provinces in September. but it never reached our hands. Altogether we were very unfortunate last year in the matter of obtaining seeds from places outside the province.

The cultivation of jute and *Malancha* was carried out under the direction of Mr. R. S. Finlow, the Fibre Expert.

An account of the experiments actually made will be found in paragraphs 11 to 19 and 22 below.

11. *Malancha* (*Malacra capitata*).—Is a new fibre introduced from Bombay. It was cultivated at Rajshahi for the second time last year (1906). The crop occupied two plots of one-fifth of an acre each. It was sown on the 13th May. The crop was treated more or less in the same fashion as jute. The plants were thinned out to about 6 inches from each other. The crop attained a height of about 7½ feet. Three-fourths of the crop was harvested on the 29th October and the remainder which was allowed to mature the seed was reaped on 10th November. The fibre was extracted by retting in exactly the same way as jute. The total outturn of fibre from the two plots amounted to 2 mds. 33 srs. equivalent to a yield of 7 mds. 2½ srs. per acre. The yield of seed from one-half of one of the plots was 12 seers or three maunds to the acre. The fibre obtained was of good quality but a market valuation of it has not yet been obtained. As already mentioned, the crop was grown under the direction of the Fibre Expert. *Malancha* is again being grown in the current year.

I (2) Malancha.

II. (1) Variety experiment with coarse winter rice.

12. Two varieties of coarse winter rice were contrasted, *viz.*, *Hatisal* of Assam and local *Gajia*. The experiment was made in two plots of $\frac{1}{5}$th of an acre each and duplicated in two more plots of the same size. The crops received no manure. The yield was as follows:—

Plot.	Variety.	Yield of paddy per acre.	Yield of straw per acre.
1	2	3	4
		Mds. srs. ch.	Mds. srs. ch.
39	Gajia ...	16 4 6	26 6 4
40	Hatisal ...	15 25 0	21 27 8
	Duplicate.		
55	Gajia ...	15 15 0	28 20 5
54	Hatisal ...	10 33 12	17 25 0

The local variety came out much the better of the two. *Hatisal* was, however, characterised by a feature which distinguished it from every other variety of winter rice, coarse or fine, grown on the Farm last year. It remained erect while every other variety became lodged before harvest. It was for this peculiar merit that I brought it for trial at Rajshahi. It is expected the yield will improve after the variety has become acclimatised to the place. *Hatisal* had also been grown on the Farm in the previous year but the variety then grown having seemed to me not true to type, the grain obtained for it was not used for seed, and a fresh stock of seed from Assam was obtained for the crop grown last year.

II (2) Variety experiment with fine winter rice.

13. Seven varieties were under trial. Their names and the sources from which they were obtained as well as their yields of grain and straw are shewn in the sub-joined statement. The experiment was made in two series of seven plots each. Each plot was $\frac{1}{5}$th of an acre. No manure

was used. Some of the plots were injured slightly by wild pigs.

Variety.	Origin.	First series.			Second series.			Average of two series.	
		Plot.	Yield per acre.		Plot.	Yield per acre.		Yield per acre.	
			Paddy.	Straw.		Paddy.	Straw.	Paddy.	Straw.
1	2	3	4	5	6	7	8	9	10
			M. S. Ch.	M. S. Ch.		M. S. Ch.	M. S. Ch.	M. S. Ch.	M. S. Ch.
1. Bansmati ...	Burdwan...	32	16 12 8	16 26 4	48	28 36 14	37 36 4	17 24 11	27 11 4
2. Maniki Madhuri	Assam ...	33	10 23 2	27 28 2	47	13 34 6	42 22 8	12 8 12	35 5 6
3. Dudkhani ..	Dinajpur..	34	16 5 0	25 14 6	50	14 20 0	22 33 12	16 12 8	24 6 9
4. Elai ...	Local ...	35	21 30 10	30 37 8	49	24 20 16	39 4 6	23 5 10	35 0 15
5. Badsabhog ...	Burdwan...	36	18 35 10	35 12 8	52	13 24 4	26 13 12	15 30 15	30 33 2
6. Kataribhog ...	Dinajpur...	37	21 2 8	36 31 4	51	19 6 4	30 8 12	20 4 6	33 20 2
7. Black Joha ...	Assam ...	38	22 15 2	34 23 2	53	13 30 0	26 32 8	18 1 9	30 27 13

The order of productiveness in respect of grain of the several varieties was not the same in the two series. In the first series black Joha came out the best, while it occupies a very low place in the second. This shews that the contrasted plots were not of an even character. The surface of several plots is still somewhat uneven—a defect which we hope to gradually correct in the process of ploughing and puddling the land. On the average of the two series, taking the results as they are, the local *Elai* stands easily first. The rest in point of yield is *Kataribhog*, one of the finest varieties grown in the Dinajpur district. *Black joha* also seems promising. In regard to the yield of straw *Maniki Madhuri* heads the list, though in yield of grain it occupies the last place.

This experiment as well as the one with coarse varieties of rice are being repeated this year.

II(3). Variety experiment with autumn rice.

14. It was intended to contrast a fine variety of autumn (*aus*) rice from the Central Provinces with a local variety of the same crop. The experiment was a failure. The Central Provinces variety of which seed had been obtained from the Bengal Agricultural Department in the previous year germinated well, but it suffered greatly from the extreme heat experienced in May and June. Much of the crop withered up in consequence. The surviving plants flowered and seeded later than the country variety, and there being

no other paddy on the ground in the neighbouring fields, it was attacked and completely destroyed by wild pigs. The local variety sown at the same time grew exceedingly well and gave the handsome yield of 33½ maunds of grain to the acre. No manure was used in this experiment.

I (4). Dacca Ganderi sugarcane.

15. For reasons already explained (paragraph 10), the experiment to test the merits of this variety side by side with those of the local *khagri* cane could not be made. Cuttings of *Dacca Ganaeri* were obtained from Dacca. The crop was planted on an area of 12½ cottahs ($\frac{5}{24}$ths of an acre). The land was manured with castor cake at the rate of 24 maunds per acre. It received no cowdung. The soil was, however, very rich, as a *basti* had stood for many years on the land before it was acquired for the farm. The crop grew with remarkable luxuriance and the yield of jaggery which it gave amounted to 142 maunds 26 seers 9 chittaks per acre which is quite three times the yield of jaggery obtained from the local variety of cane on the Farm last year. The net profit after deducting all costs amounted to Rs. 313-14 per acre. The heavy yield is ascribed partly to the richness of the soil and partly to the productiveness of *Dacca Ganderi* cane. It is not possible to say how much of the increase was due to either factor. The *Dacca Ganderi* cane was found to be exceptionally rich in sugar, the percentage of jaggery on weight of juice having amounted to 23·5 per cent. and that of jaggery on weight of cane to 14·4 per cent. In the case of local *khagri*, the highest percentages obtained on the Farm were 14·7 and 9·4 per cent. respectively. Curiously enough, the *Dacca Ganderi* which is considered a juicy sugarcane actually yielded less juice to the mill than the thin hard *khagri*, the proportion of juice to weight of cane being 53 per cent. in case of the first and 63 per cent. in the second. I have some doubt about the accuracy of the low percentage of juice in the Dacca cane and propose to test the point again in the coming season.

The success of the *Dacca Ganderi* cane has attracted the attention of neighbouring raiyats and many have asked for seed cuttings.

III. Manure experiments with winter rice.

16. Two manure experiments with winter rice were made, both in duplicate. In one, bone-meal at 6 maunds per acre was tried against no manure, and in the other green manuring with cowpea was tried against nil. The variety

of rice used was the local coarse *Gajia*. The results of the two experiments are exhibited separately below :—

Bone-meal versus *no manure*.

—	Bone-meal.	No manure.
First series.		
Plot	41	42
Yield per acre—	Mds. srs. ch.	Mds. srs. ch.
Paddy	27 10 10	18 10 0
Straw	37 38 2	30 11 14
Second series.	Mds. srs. ch.	Mds. srs. ch.
Plot	57	56
Yield per acre—		
Paddy	21 32 8	17 30 0
Straw	27 31 4	25 14 6
Average yield per acre of two series—		
Paddy	24 21 9	18 0 0
Straw	32 34 11	27 33 2

On the average of the two series, the use of six maunds of bone-meal enhanced the yield per acre of grain by about 6½ maunds and of straw by about 5 maunds. The cost of the bone-meal inclusive of the cost of application amounted to Rs. 15-10 and the value of the increase in yield which resulted therefrom to Rs. 18-11-8 taking paddy at the then current price of Rs. 2-10-9 which was higher than the normal and straw at 4 annas per maund. The net profit arising from the application of bone-meal thus came out to be a little over Rs. 3 per acre. The profit would have been somewhat greater but for the injury caused by wild pigs to one of the plots manured with bone-meal. On the other hand, the profit would have been less had the price of paddy been normal.

Green manuring with cowpea versus *on manure.*

—	Green manuring with cowpea.			No manure.		
First series.						
Plot			43			44
Yield per acre—	Mds.	srs.	ch.	Mds.	srs.	ch.
Paddy	21	13	12	10	0	0
Straw	22	21	4	23	30	0
Second series.						
Plot			59			60
Yield per acre—	Mds.	srs.	ch.	Mds.	srs.	ch.
Paddy	18	2	8	15	21	14
Straw	24	25	0	27	31	4
Average yield per acre of two series—						
Paddy	19	28	2	16	30	15
Straw	23	23	2	25	30	18

The two plots which were green soiled were sown with cowpea at the rate of 15 seers of seed per acre on the 20th March and the green crop was ploughed in on 22nd June. The crop did not grow sufficiently well, except on a portion of plot 59. The two plots have again been sown with cowpea as green manure this year and the crop is looking poor and uneven as last year. It is clear the soil is not well suited for cowpea. It is proposed therefore to substitute *Dhainche* (Sesbania aculeata) for cowpea as material for green manure next year.

The two unmanured plots remained fallow during the time that the cowpea occupied the contrasted plots. All four plots were planted with winter rice on the 7th August.

Although the cowpea crop did not grow well, its use as green manure resulted in an appreciable increase in the yield of grain, though curiously enough, it was accompanied by a decrease in the yield of straw. This result was observed in each series, as a reference to the foregoing statement will shew. The cost of growing cowpea amounted to Rs. 2-13 per acre, while the value of the increase in grain less that of the decrease in straw amounted to Rs 7-4, thus leaving a net profit of Rs. 4-13.

III(2). Manure experiments with sugarcane—castor cake.

17. Two manure experiments were made on sugarcane. The first which was designed to test the effect of an application of 24 maunds of castor cake to the acre is dealt with in this paragraph. The second will be described in the next paragraph.

The experiment with castor cake on sugarcane was made in three sets of plots, each set consisting of two plots of $\frac{1}{10}$th of an acre each. In each set one plot was manured with 150 maunds of cowdung plus 24 maunds of castor cake per acre, and the other plot received 150 maunds of cowdung alone. In all other respects the treatment was exactly alike. The local variety of cane (*khagri*) was used. The results of this experiment as well as of the one described in paragraph 18 were greatly vitiated by the injury caused to the growing crops by wild pigs, but such as they are are given below :—

Effect of castor cake 24 mds. per acre on sugarcane.

		Yield per acre of jaggery.	
		Castor cake + cowdung.	Cowdung alone.
		Mds. srs. ch.	Mds. srs. ch.
1st set	...	61 10 0	50 34 0
2nd set	...	53 21 4	50 11 4
3rd set	...	48 5 0	34 25 0
Average of 3 sets	...	54 12 5	45 13 7

Forgetting for the moment the injury caused by wild pigs no doubt unequally to the several plots, it would appear that the use of 24 maunds of castor cake increased the yield by almost 9 maunds valued at Rs. 38-4-0. The cost of the oilcake amounted to Rs. 30 taking the price of the manure at Rs. 1-4 per maund at which it was supplied to the Farm by the Rajshahi Central Jail. The price charged by the Jail was exceptionally low. This year the price of castor cake at this jail has gone up to Rs. 2-8 per maund at which rate its use would not have paid last year. But as already stated the results of the experiments were rendered quite indecisive by the ravages of wild pigs.

Manure experiments with sugarcane—castor cake *versus* *super* saltpetre.

18. The second experiment was designed to test the comparative merits as manure for sugarcane of (1) superphosphate of lime 6 maunds and saltpetre 2 maunds per acre, and (2) castor cake 24 maunds per acre. The price of 24 maunds of castor cake at Re. 1-4 per maund is about the same as that of superphosphate at Rs. 70 per ton (Rs. 2-9 per maund) and saltpetre at Rs. 7 per maund. At its present price, however, 24 maunds of castor cake

would cost just twice as much. The experiment was made in two series, each of which consisted of two plots. Each plot was $\frac{8}{10}$ths of an acre. In one series both plots were manured at the start with 150 maunds of cowdung per acre; one of these was subsequently top-dressed with castor cake and the other with super and saltpetre. In the other series no cowdung was used for either plot, otherwise the two plots were manured respectively in the same way as the two corresponding plots of the first series. The local variety of sugarcane was used. The crop was injured more or less by wild pigs. The actual results obtained are given below :—

Castor cake versus *super and saltpetre on sugarcane.*

—	Castor cake 24 maunds per acre.			Super 6 maunds and saltpetre 2 maunds per acre.		
1	2			3		
First series.	121A			121A		
Plot	2			1		
	Mds.	srs.	ch.	Mds.	srs.	ch.
Yield of jaggery	13	39	15	11	1	0
Ditto per acre	44	26	7	36	30	0
Second series.	121A			121A		
Plot	4			3		
	Mds.	srs.	ch.	Mds.	srs.	ch.
Yield of jaggery	11	19	6	10	22	3
Ditto per acre	43	30	1	40	9	8
Average yield per acre of jaggery ...	45	8	4	38	19	12

Taking the average of the two series and disregarding the loss caused by wild pigs, castor cake would seem to be the better manure of the two. It gave 6 maunds 28½ seers more of jaggery than super and saltpetre. The value of this *gur* is roughly between Rs. 28 and Rs.29 which would just counterbalance the difference in price between 24 maunds of castor cake at Rs. 2-8 per maund on the one hand *and* 6 maunds of super *plus* 2 maunds of saltpetre on the other at the prices already quoted. The prices of the last two artificials remain

more or less stationary, while the price of castor cake has recently risen very high. It would seem from the results of the experiment described above that with castor cake at Rs. 2-8, super at Rs. 2-9, saltpetre at Rs. 7 per maund, the two sets of manures would be of equal value for the sugarcane; that is to say, while the castor cake would cause a larger yield than super *cum* saltpetre, it would cost just as much more than the other as the value of the increased yield it would give; and once the price of castor cake has risen beyond Rs. 2-8, it might be more profitable to use superphosphate and saltpetre instead.

The manure experiments with sugarcane described in this and the foregoing paragraphs are being repeated in a combined form in the current year.

III(3) Manure experiment with wheat.

19. The experiment consisted in manuring wheat by dressing the land with a green crop of cowpea in the preceding rains. There were 8 plots lying in a row, four out of which were green manured, and the other four which alternated with them were left fallow during the rains. Cowpea was sown on the 31st March and ploughed in on the 22nd September. The growth was remarkably luxuriant.

Owing to heavy rain at the end of October and the beginning of November, the preparation of land for wheat was greatly retarded and further delay in sowing was caused by the non-receipt of Muzaffarnagar wheat seed which it was my intention to sow on the land. Eventually local wheat had to be sown. The sowing was made on 29th November when seed time for wheat had almost past. The crop suffered also from rust which appeared in an exceptionally virulent form in the wheat fields round the Farm. Owing to these causes, the yield of grain was very poor. The average yield of grain per acre from the plots manured with cowpea amounted to 4 maunds 22 seers against 3 maund 31 seers obtained from the unmanured plots. The outturn of straw amounted to 15 maunds 10 seers and 10 maunds 25 seers, respectively. These are very poor yields which afford no proper basis for comparison. However, the slight increase in the yield of grain (31 seers) and straw (4 maunds 25 seers) more than compensated for the cost of the green manurial. The latter amounted to Rs. 2-0-6 while the value of the increased yield amounted to Rs. 3-11-10, the price of wheat being taken at Rs. 3-5-4 and of straw at 4 annas per maund.

It is proposed to crop the eight plots with wheat again in the ensuing season to see if the green manure shews any effect on its growth and yield.

IV. New implements.

20. Among the new implements used on the Farm, the Hindustan plough continues to do excellent work. It was obtained in 1905 from Messrs. T. E. Thomson and Company, at a cost of Rs. 18. I proposed to try Mr. Hadi's apparatus for manufacturing sugar, but the question whether it should be tried at all in this province remained undecided till it was too late for trial in the year under report. An indent for a set of apparatus was sent in March last to the Director of Land Records and Agriculture, United Provinces of Agra and Oudh. It is hoped it will arrive in time for use in the coming *gur*-making season.

V. Seed selection with winter rice.

21. My intention is to breed selected strains of two local varieties of rice, and another of the Hatisal variety of Assam by a process of continuous selection of seed grain for several years in succession. The initial step in this experiment was taken last year when the Farm Superintendent selected a quantity of grain of each of these three varieties by choosing the best ears of corn and the plumpest grains from these ears. The work of selection was to have been done in the field, but the Superintendent was unable to carry out my instruction in consequence of the crops having become lodged, and he made the selection after the crops had been gathered on the threshing floor. This year the selected seeds will be sown and the seedlings carefully transplanted 12 inches apart, each seedlings being set separately by itself, so that the character of each plant may be individually studied. It should enable us to choose the clumps which have made the best growth and are most healthy and which exhibit at the same time those characteristics which are looked for in a good crop of rice. From these plants, the stoutest grains will be saved for sowing in the next year.

VI. Jute cultivation.

22. The object of growing jute last year was to test the evenness or otherwise of the land. The cultivation was carried out under Mr. Finlow's direction. All land on the Farm which was not occupied by or required for other experimental crops was sown with jute. The total area under the crop was 12·6 acres. The crop was thinned out to about 10 inches and allowed to seed.

The season proved unfavourable. Sowings were retarded for want of rain in April and the first part of May. In October, there was an unusual amount of rain which interfered greatly with the proper gathering of the seed. Much of the seed was lost in the act of gathering it in the field. A further loss of seed took place in the threshing yard. The seed pods remained moist too long and could not be threshed in time to save all the seed. This untoward result could have been avoided if there had been a covered barn on the Farm. The total yield of seed from the 12·6 acres was 59 maund's 9 seers and of fibre 59 maunds 5 seers. The acreage yields of seed and fibre amounted in each case to 4·7 maunds. The yield of fibre was particularly poor, mainly in consequence of the stems having become overripe and dry when reaped.

The bulk of the jute crop was of the *Deswal* variety of Sirajganj. The seed obtained last year was saved for distribution during the current year.

Non-experimental crops.

23. The details of the non-experimental crops grown during the year are exhibited in the following statement.

Crop.	Area.	Manure per acre.	Yield.	Profit.	Loss.	Remarks
1	2	3	4	5	6	7
	Acres.	Mds.	M. s. ch.	Rs. a. p.	Rs. a. p.	
Winter rice ...	5·00	Nil ...	80 34 8	107-8-6	...	
Sugar cane (local).	0·88	Cowdung 150 Castor-cake 24	45 1 2	21-10-9	...	
			cobs.			
Maize ...	0·85	Cowdung 150	5,415	...	0 4 9	Green cobs sold, stalks used as fodder.
			M. s. ch.			
Wheat (local red).	0·80	Nil ...	3 3 6	...	21 11 6	A very poor crop. Reason for failure the same as for experimental crop (paragraph 19).
Oats (local) ...	0·80	Nil ...	14 10 0	4 14 0	...	
Jowar (fodder)	2·63	Nil ...	Used as fodder	114 14 9	...	A luxuriant crop.
Total ...	10·96	...	...	249 0 0	22 0 3	

Distribution of seeds.

21. The seed distributed by the Farm last year consisted of 15 seers of fine winter rice and 46 mds. 12 srs. 8ch. of jute seed raised in the previous year. The winter rice seed was supplied to the Director of Agriculture in Kashmir. A list of the parties supplied with jute seed is appended to the report. Among them was the Collector of Rajshahi who took 24 mds. for distribution among selected cultivators in his district.

Receipts and expenditure.

25. The receipts of the Farm for the year under report amounted to Rs. 1,817-6-6, and the expenditure to Rs. 5024-8-3. The latter included a sum of Rs. 600 for capital charges, and Rs. 1,518-10-6 for pay and travelling allowance of establishment.

Visits of inspecting officers.

26. His Honour the Lieutenant-Governor paid a visit to the Farm in July 1906. The Farm was inspected in December last by the Director of Land Records, Mr. N. D. Beatson Bell and three times during the year by me. Mr. S. G. Hart, the present Director of Agriculture paid frequent visits to the Farm while he was Collector of Rajshahi. The present Collector, Mr. A. H. W. Bentinck visited the Farm several times during the year and the Department is indebted to him for the keen interest he has been taking in its management.

B. C. BASU,

Assistant Director of Agriculture.

Shillong,
The 6th July 1907.

APPENDIX.

List of persons supplied with jute seed in 1906-1907.

Name and address of party.	Quantity of seed supplied.	Remarks.
1	2	3
	Mds. srs. ch.	
Director of Agriculture, Punjab	0 20 0	Under instructions of Mr. Finlow.
Superintendent, Mirpur Khas Farm, Sind ...	0 10 0	Ditto.
H. B. Smith, Esq., Mogalhat	2 0 0	Ditto.
Director of Agriculture, Burma	0 10 0	Ditto.
L. W. Middleton, Esq., Digaru, Assam ...	5 0 0	Ditto.
Agricultural Inspector, Samalkota Farm, Madras	3 0 0	Ditto.
Traffic Manager, Chittagong	1 0 0	Ditto.
Messrs. Lawson and Co., Dehra Dun ...	0 5 0	Ditto.
Deputy Director of Agriculture, U. P. ...	0 2 0	Ditto.
Superintendent, Jorhat Farm	0 5 0	Ditto.
C. Forbes, Esq., Badlipar Tea Estate, Assam...	1 0 0	Under instructions of the Director of Agriculture.
Mr. Christie, North Lakhimpur	2 10 0	Ditto.
Babu Man Gobinda De Choudhury, Silchar ...	0 1 8	Ditto.
Manager, Burdwar tea estate, Assam ...	2 10 0	Ditto.
Babu Chandra Kanta De, Rasulpur, Mymensingh	0 2 0	Ditto.
Government Pleader, Rajshahi	0 6 0	Under instructions of the Collector, Rajshahi.
Manager, Charani Wards estate	3 5 0	Ditto.
Nazir, Rajshahi Collectorate for distribution to cultivators through the Police.	24 0 0	Ditto.
Rai Bahadur Kumudini Kanta Banerjee, Rajshahi	0 1 8	Ditto.
Abdul Khan, Rajshahi	0 1 8	Ditto.
Jailor, Rajshahi	0 3 0	
Jad Singh, Badlipar, Assam	1 0 0	
Total ...	46 12 8	

Annual Report of the Jorhat Agricultural Station for the year ending the 30th June 1907.

Introduction.

THIS station, ordinarily spoken of as the Jorhat Sugarcane Farm, was established in January 1906, and is to be devoted principally to the investigation of sugarcane. The present report deals with the crops grown during the first year of cultivation, namely, during the rains of 1906 and the cold weather of 1906-1907. The agricultural year under report covers a part of the current rainy season, and there were several young crops, including sugarcane, on the ground at the close of the year. These crops will be noticed in detail in the next Annual Report of the Farm, and only a brief mention of them will be made in the present report (see paragraphs 18 and 19).

History and description.

2. As stated above, the Farm came into existence about a year and a half ago. It is situated about three miles to the south of the Jorhat town. The total area of the Farm is 35·5 acres, out of which 1·7 acres is low land, which has been cultivated with winter rice for many years past, and the rest is high land, which was under pasture grass and light scrub jungle at the time it was taken up for the Farm.

Soil.

3. The soil of the Farm is a sandy loam of a slightly reddish colour, and belongs to the formation known as the "oldalluvium." This class of soil occurs over extensive tracts in the Assam Valley, and is cropped largely with sugarcane in certain parts, notably in the Golaghat subdivision of the Sibsagar district adjoining the Jorhat subdivision on the west. It is expected that any useful results that may be obtained with sugarcane on the Jorhat Farm will apply to the large area of country in the Assam Valley containing soils of the same description and origin.

Two average samples of the surface and subsoil of the Farm have been recently analysed by Dr. Leather, whose report is quoted below:—

	Surface soil. Percentage.	Sub-soil. Percentage.
Organic carbon...	1·16	·68
„ nitrogen	·104	·051
Calcium carbonate	·229	·091
Total phosphoric acid	·038	·030
Available „ „	·004	·001
„ potash	·005	·002
Sulphuric acid	·002	·001

The surface soil contains more organic matter than is common to the Indo-Gangetic alluvium, and the amount of calcium carbonate is quite sufficient for agricultural purposes. It contains too little available phosphate and potash, and I am sure it will respond to these fertilisers, if they are tried.

Since receipt of the foregoing analyses four fresh samples of surface soil taken from the four main blocks of land in the Farm, together with four corresponding samples of subsoil, have been sent to the Imperial Agricultural Chemist for analysis. His report on the samples is awaited.

Preparation of the land for experimental cultivation.

4. An account of the preliminary work which was needed to make the land fit for cultivation was given in the last annual report of the farm. Much levelling work was done in the preceding year, but much still remains to be done. The surface soil was disturbed in many places, and it was thought desirable to postpone comparative experiments over the greater portion of the farm until the fertility of the soil was reduced to a fairly uniform level by a continuous system of cropping. With this object one of the four main blocks of land, namely, the one on the north-east of the Farm, having an area of 4 acres, was cropped with maize during the rains of 1906, and the entire area available for cultivation, except two acres which had been planted with sugarcane, was sown with oats in the cold weather following. The aggregate area sown with oats amounted to 21 acres. No manure was used for either the maize or the oats crop.

The maize crop in the north-eastern block grew unevenly. It was on the whole a poor crop, though it grew well enough to show the difference in point of fertility between the different parts of the field. While the crop was on the ground the field was mapped out into a number of plots, each apparently uniform as far as the appearance of the crop was concerned, and presumably uniform therefore in respect of fertility.

The succeeding crop of oats in this field (the north-eastern) exhibited the same degree of unevenness as the maize crop. This crop too was a poor one, but it was observed that the areas in which maize had grown best coincided roughly with those in which oats too showed the best growth. The field was mapped out a second time into plots of uniform fertility so far as it could be judged from the appearance of the oats crop. This map, together with the one prepared on the basis of the maize crop, is being utilised in partitioning the field into plots.

The oats crop in the remainder of the Farm sprouted well, but withered up soon after germination, owing, it is believed, either to want of moisture or to excessive rawness of the soil or to both. The failure of the crop frustrated the object with which it was sown, namely, to test the evenness of the soil and to mark out areas exhibiting different degrees of growth of the crop.

It has been decided, in consultation with Dr. H. Mann, to abandon the attempt to divide the land of the Farm (with the exception of the north-eastern block) into plots of uniform fertility as far as it can be judged by the appearance of a growing crop. The plan which is now being pursued is to cut up the cultivated area in such a way that each plot may be fairly level without disturbing the surface soil too much and then to crop it without manure for one or more years in order to reduce the whole of it to a uniform level of fertility. It is expected that the repeated ploughings to which it will be subjected in the course of a year or two will cause the surface soil in different parts of a plot to be intermingled and thus reduce such inequalities within the plot as may originally exist.

Equipment of the Farm.

5. *Buildings.*—The buildings on the Farm consist of temporary huts for the housing of the fieldman clerk and a number of coolies, a temporary shed for cattle and a kutcha house containing the office of the Farm and serving also as a rest-house for inspecting officers. The Superintendent has to live in the town 3 miles away for want of accommodation on the farm. The construction of quarters for this officer is among the works most urgently needed. Other urgent works are the erection of a godown and an office and of a properly-constructed shed for the housing of cattle. These works will be soon taken in hand.

Fencing.—The Farm was enclosed during the year with a wire fence at a cost of Rs. 2,259-2.

Implements.—The following implements of foreign manufacture were purchased during the year :—

One cultivating machine from Messrs. Macbeth & Co., Bombay, price Rs. 61-12.

Two Planet Junior hand hoes, single wheel, price Rs. 22-8 each.

Two Steel garden rakes, price Re. 1-7-0.

One platform weighing machine (Avery's), price Rs. 60-12.

Besides the foregoing, a three roller sugar mill and two shallow iron pans were procured in March last from Messrs. Thomson and Mylne, of Behea, at a total cost of Rs. 180-8.

The cultivating machine has not yet received a fair trial. The Planet Junior hand hoe has been found useful in cultivating between the rows of sugarcane and maize and when fitted with a small steel plough, it has proved very handy for making shallow furrows in planting cane. The graden rakes have proved to be of no particular use in field cultivation. The three roller sugar mill and shallow iron pans were used in manufacturing jaggery on the farm. They are undoubtedly superior to the wooden screw mill and deep earthen or metallic pans used in the Assam Valley. The merits of the new appliances cannot be brought vividly home to the people without a side-by-side trial of the two methods of manufacture. I wish to have such a trial made on the farm in the next season, and to invite cultivators from the neighbourhood to witness it and compare the results.

Water supply.—Much inconvenience was experienced by the resident staff of the Farm for want of good drinking water during the last cold weather. The ravine which had been dammed retained very little water, and what water there was soon became unfit for use. It was accordingly decided to deepen a part of the ravine at an estimated cost of Rs. 800. The work was taken in hand about the end of March, but it could not be completed owing to the paucity of labour available at the time. In all, about 40,000 cubic feet of earth work, costing about Rs. 320, has been done. The work will be completed in the next dry season.

Character of the season.

6. The rainfall recorded at Jorhat, the nearest rainfall station to the Farm, during the agricultural season extending from 1st April 1906 to 31st March 1907, is shown in the table given below. I consider it needless to quote the rainfall of the quarter ending the 30th June 1907, as it could not in any way affect the yield of the crops deal with in this report.

Rainfall at Jorhat.

Month.	1906-1907.		Normal.	
	Rainfall (inches).	Number of rainy days.	Rainfall (inches).	Number of rainy days.
April	14·98	18	8·36	13·4
May	11·03	19	9·62	14·6
June	13·20	16	11·52	15·9
July	5·67	13	15·24	18·2
August...	17·52	23	14·22	16·7
September	7·70	13	9·33	13·2
October	2·35	4	4·04	6·4
November	0·34	2	0·54	1·5
December	...	...	0·60	1·5
January	1·85	5	0·93	2·9
February	0·51	2	1·41	4·0
March	2·97	11	4·28	8·1
Total for year	78·12	124	80·09	116·4

The season proved favourable to the sugarcane crop. There was no rain for nearly two months and a half from the middle of November, but this did not have any visible effect on the crop. The absence of rain during this period is, however, held responsible, at least partly, for the failure of the oats crop.

Programme of experimental cultivation in 1906-1907.

7. Sugarcane was the only experimental field crop grown during the year. Mention will be made later on of several kinds of fruit trees and Caravonica cotton which have been planted in the compounds of the several houses. These are being treated as garden crops. Considerable areas as already stated were sown for a special purpose with maize and oats. The crops were non-experimental, and the results of their cultivation, poor as they were, have already been noticed.

I stated in my last annual report on the Farm that the programme of sugarcane cultivation was restricted, on the advice of the Inspector-General of Agriculture, to the growing of as many varieties of cane as could be procured with the two fold object of making a study of their field

characters and of securing an adequate supply of cuttings for future experiments. Accurate investigation of the factory characters (*e.g.* sugar content and purity of the juice) of the different varieties, and of each variety at different stages of growth or under different methods of cultivation and manuring cannot be undertaken until the services of a Chemist are available for conducting analyses on the spot.

Sugarcane crop of 1906-1907.

8. The sugarcane crop occupied two acres in all. Out of this area, one acre, consisting of two equal plots was devoted to a trial of ten different varieties of cane. Each of the two half-acre plots was divided into ten equal strips or sub-plots, and each strip was planted with one particular cane, so that there were two series, each of which consisted of ten strips bearing ten distinct varieties of cane. The remaining one acre was cultivated with Mag cane, and had no other purpose to serve except to provide cuttings for the curent season.

The ten varieties under trial in the two half acre plot were :—

Striped Mauritius.	Majhara.
Red Mauritius.	Teli.
Paunda.	Mag.
Samsara.	Kalaputra.
Khari.	Bagapura.

The *Striped* and *Red Mauritius* came from the Samalkota Farm in Madras. The *Paunda* is a variety grown as chewing cane in the United Provinces. Cuttings of this variety were supplied by the Agricultural Department of Assam some years ago to Babu Debeswar Gossain, owner of the Barpathar Sugarcane Farm in the Golaghat subdivision. The cuttings used in the Jorhat Farm were obtained from this gentleman. Cuttings of the *Samsara* and *Khari* varieties, which originally came from Bengal, were also supplied by him. The remaining varieties are indigenous to the Assam Valley.

All the ten varieties received as nearly as practicable the same treatment. Following the usual method of planting in vogue in the neighbourhood, the cuttings were planrte in the first instance in a nursery, and after they had germinated and produced shoots 12 to 18 inches long, they were

taken up and replanted in the field. The planting took place about the middle of May. This method of planting is particularly well-suited for land which is liable to suffer from drought and in which ungerminated sets which are necessarily planted earlier in the year are apt to fail from want of moisture.

The crop received the following manures :—

Cowdung—400 maunds per acre.

Rape-cake—21 maunds 22½ seers per acre.

The cowdung, following the practice of the Assamese, was dried and reduced to powder before application, and it was used in three separate doses, namely, once at the time of planting and twice during the rainy season. It was not my intention to use rape-cake, but when white ants became troublesome, and there was no other handy remedy available, I directed it to be used in small doses. The aggregate of the doses applied amounted to 21 maunds 22½ seers per acre as given above. The canes were earthed up at the end of July, and the ground round the growing clumps was kept clean and loose by frequent weedings and hoeings during the rainy season. The canes were not wrapped with leaves, but were stripped as the leaves became old and dry. The taller clumps had to be supported by bamboos or by tying the heads of several together. This was particularly necessary in case of the two varieties of Mauritius cane, *Kalapura*, *Khari*, and *Majhara*, which are taller than the others.

Insect pests on the sugarcane.

9. Borers injured canes more or less in every variety. *Samsara*, and *Paunda* appeared to have suffered most, and *Majhara* and *Khari*, the least. I collected some pupæ from infested canes, but failed to rear them into moths. The borer remains to be identified. White ants gave considerable trouble. The land had previously contained numerous white-ant mounds and though these had been levelled down, the ants remained concealed below the soil and attacked the canes growing near their nests. All varieties suffered more or less. *Kalapura* seemed to have suffered the most, owing, it was believed, to its proximity to a nest of white ants, but I now think that much of the injury which was apparently caused by white ants to this variety was really due to the presence of fungous disease. The pest was kept in check

by continual application of small doses of rape cake wherever and whenever it appeared. Crude-oil emulsion watried, but the Superintendent reported that it failed to check the pest.

Fungous disease.

10. One of the ten varieties, *Bagapura*, succumbed wholly to disease, which has been identified by Dr. Butler to be no other than the well known red-smut or red-rot disease of the sugarcane, known to science as *Colletotrichum falcatum*, Went. The disease caused much loss also in the *Red Mauritius* and *Kalapura* varieties and was slightly present in *Striped Mauritius*. The disease has already manifested itself again in the ratoon canes of these varieties, and some of the sprouted cuttings planted this year already show symptoms of disease in spite of the care taken in selecting them. The two sub-plots of *Bagapura* were damaged to such an extent that the clumps had to be uprooted and destroyed by fire. A part of the *Red Mauritius* cane was also taken out and destroyed in the same way. This was done with the object of checking the spread of the disease. Dr. Butler thought that the method we had adopted was not likely to be of any use in checking the disease, and the only preventive remedy which he could recommend lay in careful selection of seed cuttings consisting in discarding all cuttings showing the least trace of redness at the cut ends.

Harvesting of experimental sugarcane.

11. The sugarcane crop in the two plots under variety experiment was harvested between the 21st March and the 25th April. The work could not be got through quicker, only a single mill having been available for crushing the canes. The long time over which the operation extended would prevent a strict comparison between the recorded yields of the different varieties being made. It is very possible, indeed probable, that some of the varieties which were crushed last became over-ripe, and consequently deteriorated in respect of the percentage as well as of the quality of the juice. Even before the harvesting commenced I had noticed that several varieties, notably *Teli*, *Khari*, and *Majhara* had thrown out shoots of considerable length from the nodes, which I consider as a sure sign of over-ripeness.

Field characters of the varieties.

12. It was all along my intention that a continuous study of the field characters of the several varieties under trial should be made, but I failed to get this done owing to the absence of the Farm Superintendent for three months on leave. It is proposed to maintain such a record for the current year's crop on certain lines recommended by D. Mann. In regard to the last year's crop, I took down some notes after examining each variety a few days before the harvest commenced. Only nine varieties were then on the ground,—one variety, *Bagapura*, having been uprooted and burnt before my visit. These notes, subsequently supplemented by ascertaining the average number of canes per clump and the average number of canes that went to the maund for each variety, are reproduced in the table which follows.

Table showing the field characters of the varieties of sugarcane under trial, 1906-1907.

Variety.	Colour.	Internodes.			Average height of cane (feet).	Average number of canes per clump	Average number of canes per manuel.	Habit of growth.	Aerial roots.	Leaves whether adherent or falling off readily.	Ratoon *growth* in middle of March.	Insect and fungous disease.	Remarks.
		Shape.	Average length (inches).	Average girth (inches).									
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Striped Mauritius.	Striped with alternate bands of dark red and yellow.	Cylindrical ..	5 to 6	4	8 to 10	5·8	33	Lank; requires support.	Slight; most canes clean.	Shed as soon as dry.	Fair ..	Slightly diseased (red smut.)	Shows numerous "sports" in which the canes are of a greenish yellow colour blotched with red. Some clumps are entirely composed of this kind of cane and in a few clumps striped and "sport" canes are found together.
2. Red Mauritius.	Red ..	Ditto ..	5	4	8 to 10	6·1	35	Ditto ..	Practically none.	Fall off readily but less readily than No. 1.	Slight ..	A considerable proportion of canes died from red smut.	
3. Puam 'a	Green with slight yellowish tinge; lower one blotched with red.	Ditto ..	4	4	4 (remained dwarf).	6·2	56	Perfectly erect; canes not high enough to lodge.	Profuse up to 5th or 6th joint.	Fall off; but not so readily as in No. 1.	Nil ..	Too many borer holes.	

4. Majhara	Dirty black, with coating of sooty mould which comes off on rubbing, revealing a light yellow or greenish yellow rind. (See remarks.)	Slightly thick at node. Constricted below node. Slight bend at every node.	4	2½ to 3	8 to 10	9·2	56	Liable to lodge, being thin and long.	Very few .	Adherent ..	Slight ..	....	In some clumps the canes are of a light red colour, which extends for some distance above each node, and in some up to the next node. Eyes round and prominent; many are swollen or have thrown out shoots.
5. Khari ..	Ditto ditto, but lighter colour.	Ditto ..	4	2½ to 3	8 to 10	11·7	67	Ditto ..	Ditto ..	Ditto ..	More ratoon growth than Majhara.	....	The same remarks as regards eyes and shoots as, for Majhara. Indeed, these two varieties seem identical.
6. Teli ..	Deep purple with white bloom.	Almost cylindrical; slightly thick at node.	3 to 4	3 to 3½	8	6·6	61	Erect ..	Very few ..	Fall off, but not so readily as in No. 1.	Considerable	....	Eyes very prominent: round with tendency to shoot out in the field.
7. Mag ...	In young cane and young joints reddish or red on one side and greenish yellow on other; in old joints red colour disappears.	Cylindrical ..	4	3½	8 to 9	5·0	34	Fairly erect; less liable to lodge than No. 1 or No. 2.	Plentiful up to 8th joint; in some as far up as 10th.	Ditto ..	Slight ..	....	Eyes fairly prominent; the canes had still (on 12th March) a fresh healthy look.
8. Samsara	Ditto ..	Cylindrical, but lower third of internode seems slightly thicker than upper two thirds.	4	4	4	6·2	57	Erect .	Profuse up to 5th or 6th joint.	Ditto ..	Nil ..	....	Very similar to Paunda.
9. Kolapura.	Deep purple with white bloom.	Tumid; constricted at node.	4	5 (thickest of all).	6 to 7	4·3	35	Lank; requires support.	Practically none.	Shed off easily.	Very slight.	Much injured by red smut and white ants; the latter probably by accident.	Most canes were cracked.

An examination of the ratoon crop made by me early in June, some weeks after the harvest of the plant cane, showed that *Striped Mauritius*, *Khari* and *Teli* still exhibited the best ratoon growth, while *Red Mauritius* and *Majhara*, of which the ratoon growth was scanty in March, have since come up well. *Samsara*, *Mag* and *Paunda* also have thrown out considerable quantities of shoots from the roots, but these lag far behind the former in health and vigour. *Kalapura* showed an indifferent ratoon growth and many shoots had already died or were dying from the attack of red-rot.

Yields of cane, juice nd jaggery.

13. The results obtained by crushing the canes of the several varieties and manufacturing the juice into jaggery are exhibited in the statement given below for each of the two plots under the experiment.

Yields of varieties of Sugarcane, 1906-07.

Variety.	Plot 4.					Plot 5.				
	Area in acres.	Number of clumps.	Weight of cane.	Weight of juice.	Weight of jaggery.	Area in acres.	Number of clumps.	Weight of cane.	Weight of juice.	Weight of jaggery.
1	2	3	4	5	6	7	8	9	10	11
			Mds. srs.	Mds. srs.	Mds. s. ch.			Mds. srs.	Mds. srs.	Mds. s. ch.
1. Striped Mauritius	0·05	180	27 36	21 24	4 1 4	Not duplicated for want of cuttings.				
2. Red Mauritius	Uprooted on account of disease.					0·05	142(*a*)	21 29	15 18	2 0 8
						0·025	90(*b*)	16 10	12 13	1 34 4
3. Paunda	0·05	180	19 33	13 5	2 24 10	0·05	180	19 28	13 5	2 25 10
4. Majhara	0·05	180	29 36	16 39	2 33 8	0·05	180	29 35	16 33	2 36 12
5. Khari	0·05	180	31 12	17 24	3 11 12	0·05	180	31 15	17 13	3 5 5
6. Teli	0·05	180	18 5	9 4	1 37 8	0·05	180	21 1	9 36	2 2 12
7. Mag	0·05	180	30 32	15 38	3 33 0	0·05	180	23 38	12 15	2 13 0
8. Samsara	0·05	180	18 21	9 36	2 16 11	0·05	180	20 14	11 16	2 16 0
9. Kalapura	0·05	144(*c*)	17 31	9 25	2 14 4	Not duplicated for want of cuttings.				

(*a*) Out of 180 clumps originally planted 38 died out completely.
(*b*) The plot was originally 0·05 acre, but disease having appeared, the clumps on one-half of the area which stood next to *Sugapura* were rooted out.
(*c*) Out of 180 clumps originally planted 36 died out completely.

A glance at the above table would show *Striped Mauritius*, one of the newly-introdnced varieties, to have produced the largest quantity of jaggery. *Khari* came next, *Mag* came off second best in plot 4, but for some unaccountable cause, it gave a much poorer yield in plot 5. It would be unsafe, however, to draw any definite conclusions as to the relative merits of the several varieties merely on the evidence of the results obtained in one season, particularly when there were within our knowledge a number of circumstances which affected unequally the different subplots under contrast. The land to begin with had not been tested for evenness, and one cannot be certain that the contrasted areas possessed the same degree of fertility. The seed cuttings of the different varieties were obtained from different places, some having come from a long distance, and it was not to be expected that all of them were equally fresh at the time of planting. The different subplots again were affected unequally by white ants, and the harvesting operations, which extended over five weeks, must have unequally told on the yields of the different varieties.

Quality of cane and juice.

14. The following statement exhibits the percentages—

(1) of the weight of juice on weight of cane,
(2) of the weight of jaggery on weight of cane,
(3) of the weight of jaggery on weight of juice :—

Variety.	Plot 4.			Plot 5.		
	Percentage of juice on cane.	Percentage of jaggery on cane.	Percentage of jaggery on juice.	Percentage of juice on cane.	Percentage of jaggery on cane.	Percentage of jaggery on juice.
1	2	3	4	5	6	7
1. Striped Mauritius	77·4	14·4	18·7	...	...	...
2. Red Mauritius	...	...	...	71·1	9·2	13·0
				67·6	10·2	15·0
3. Paunda	66·2	13·2	19·9	66·6	13·4	20·1
4. Mujhara	56·7	9·5	16·7	56·7	9·8	17·2
5. Khari	56·2	10·5	18·7	53·1	10·0	18·1
6. Teli	50·2	10·7	21·3	47·0	9·4	20·9
7. Mag	51·8	12·4	24·0	54·2	10·2	18·8
8. Samsara	53·4	13·0	24·4	50·0	11·6	21·9
9. Kalapura	54·1	13·2	24·6	...	...	...

From a study of the foregoing statement, the following conclusions may be drawn, though these should not be accepted as final, pending their confirmation by future trials :—

(1) In respect of juiciness, *Striped Mauritius* and next to it *Red Mauritius* stand pre-eminent. The third in order is the *Paunda*. These three canes have yielded high percentages of juice. The other varieties are left far behind. *Kalapura*, which possesses the reputation of being the best local chewing cane shows a low percentage, due, it is believed to much of the cane being dead and dry, when pressed. *Teli* is the least succulent of all.

(2) In respect of the percentage of *gur* on cane, *Striped Mauritius* heads the list again, in spite of the fact that its juice is thinner than that of most other canes. *Kalapura* *Paunda* and *Samsara* come next.

(3) In respect of the richness of the juice as judged by the percentage of jaggery on juice, *Kalapara* and *Samsara* appear to be the richest. For some reason, which I have failed to discover, the absolute yield of jaggery from *Mag* as well as its percentages on cane and juice in plot 5 were very low as compared with the corresponding results obtained in plot 4. Nevertheless, the average of the two plots taken together would seem to indicate this variety to be richer in sugar than any of the other canes except *Kalapura* and *Samsara*. It is expected that on chemical analysis the juice of *Samsara* and *Mag* will be found to contain 20 per cent. or perhaps more of sugar. Ordinary jaggery does not contain more than 10 per cent. of moisture. Deducting 10 per cent. from the average of the percentages of jaggery on juice of the two varieties named above, the percentages of sugar in their juice would appear to be as follow :—

	Percentage of jaggery on juice.		Average of two plots.	Percentage of sugar after deducting 10 per cent. for moisture.
	Plot 4.	Plot 5.		
1	2	3	4	5
Samsara	24·4	21·0	22·7	20·43
Mag	24·0	18·8	21·4	19·26

Kalapura might be still richer.

Purity of juice; quality of jaggery.

15. Nothing can be said as yet as to the relative purity of the juice of the different varieties under trial. The purity of the juice is determined by the proportion which the saccharose (crystallizable sugar) bears to the glucose (non-crystallizable sugar) in the juice, the two together forming the total sugar content of the juice; and on it depends the proportion of crystallizable sugar that can be recovered. The purity of the juice is of the highest importance to the manufacturer of sugar, and is also of some value in the manufacture of jaggery, in so far as its quality is dependent to a large extent upon the proportion of crystallized sugar which it contains.

The following observations have been made by the Farm Superintendent in respect of the quality of jaggery produced by the several varieties under trial:—

Samsara—Excellent quality; large crystals; pleasant flavour,

Mag—Almost equal to *Samsara*.

Striped and Red Mauritius—Jaggery whitest of all; grain smaller in size than in case of *Samsara* and *Mag*.

Khari—Jaggery of low quality; darker colour and apt to run.

Majhara—Ditto, even worse; jaggery sticky and few crystals.

Teli—Similar to that of *Khari*; peculiar somewhat unpleasant taste.

Paunda—Similar to *Samsara*, but less crystalline.

Kalapura—Almost equal to *Samsara* in respect of colour and crystals.

Non-experimental sugarcane.

16. The non-experimental sugarcane occupied an area of exactly one acre. The variety grown was the local *Mag*. The crop was cultivated and manured in exactly the same way as the experimental cane. The results obtained are stated below :—

Total number of clumps	...	...	3,672
Total number of canes	...	...	21,517
Average number of canes per clump		...	5.8
Ditto—per maund of cane	...	...	40

		Mds.	srs.	ch.
Weight of cane	...	...541	9	0
Weight of juice	...	...271	36	0
Weight of jaggery	...	...56	20	4
Percentage of juice on cane	...	...	51·1	
Percentage of jaggery on cane	...	...	10·4	
Percentage of jaggery on juice	...	...	20·4	

The crop was grown mainly with the object of obtaining cuttings for planting in the current year.

Cost and income of sugarcane cultivation.

17. The total expenditure for the sugarcane crop, which occupied two acres in all, amounted to Rs. 747-0-11, exclusive of the charges for the mill and the cost of the cuttings obtained from Madras. The total recovery from the sale

of jaggery, including estimated value of stock in hand, amounted, to Rs. 509-3-3 The price of the cuttings obtained from the crop most part of which has been used for the current crop has not been included in the above. The estimated value of the cuttings was about Rs. 60.

Sugarcane cultivation in current year.

18. The programme of sugarcane experiments for the current year has been decided in consultation with Dr. Mann, who paid a visit to the Farm early in April last. The programme includes—

(1) An experiment to test the merits of ten varieties of sugarcane, nine of these being the same as was grown last year (*Bagapura* being omitted and one *Dacca Ganderi* being added.) It is proposed to make a continuous study of the field characters of each variety during the growing season.

(2) An experiment, conducted partly for our own information and partly as a demonstration to the surrounding raiyats, on the most profitable amount of cattle manure and oilcake to apply. The manures to be tried being as follows :—

(*a*) 300 mds. of cowdung and 20 mds. oil cake per acre.
(*b*) 150 „ „ „ 10 mds „ „ „
(*c*) 75 „ „ „ 5 mds „ „ „
(*d*) 300 „ „ „ and no oilcake per acre.
(*e*) 150 „ „ „ „ „ „

(3) An experiment in ratooning on the two plots planted with varieties last year.

(4) A selection experiment consisting in selecting the 20 best cuttings of each variety picked out from the healthiest clumps of cane in the variety plots of last year.

The crop in all the four experiments has been planted. The first three experiments have been laid out in duplicate. and occupy nearly one acre each.

In addition to the varieties under trial in experiment (1), a consignment of four of the best varieties of sugarcane, grown in the West Indies was received during the year from the Agricultural Department of Barbadoes. The canes were procured through the Superintendent of the Royal Botanic Garden, Sibpur. The four varieties are B.208, B.147, B. 1753 and B.376, all being varieties originally raised in Barbadoes from seed. The canes arrived on the last day of May. There

were 11 canes of B. 208, 9 of B. 147, 8 of B. 1753 and 9 of B. 376; total 37. The canes had thrown out shoots, and it was thought risky to steep them for disinfection in Bordeaux mixture or kerosine emulsion for fear of injuring the tender shoots. Each cane was, however, carefully examined for insects, of which no trace was found, and at the time of putting them out in the nursery, each cane was cut into two or three pieces to see if it exhibited any sign of red rot. Five canes (three of B. 1753 and one each of B.208 and B. 376) were found on cutting to be more or less reddened inside and accordingly rejected. The remaining canes seemed perfectly healthy. The canes were planted in the nursery on the 2nd June and have been transplanted since the close of the year in a plot away from the main cane crop on the Farm.

Other experimens in current year; jute.

19. The only other field experiment initiated during the current year consists of some trial sowings of jute made under the direction of Mr. Finlow, the fibre expert of the department. The only object of the experiment is to see whether jute will grow well on the soil of the Farm. The crop has been sown in three plots, two of which are high land and the third is situated in a shallow ravine. One of the two high land plots was sown twice, once on 28th April, and this having failed, a second time on 25th May. The ravine land became water-logged early in the season except in a small patch, about an eighteenth of an acre, which was sown on 2nd May. The second high land plot, which borders on the ravine, was sown on 6th May. In none of the plots has the crop germinated with sufficient evenness, and the high lands being sloping, much of the surface soil has been washed away by heavy rain occurring soon after the sowings took place. The prospects of the crop are not hopeful. The sowings were evidently made too late in the season. Earlier sowing, say between the middle of February and middle of March, is likely to give better results. The soil of the Farm appears to me to have some defects which may prevent jute from being successfully grown on it. It is deficient in the power of retaining moisture in the dry weather, and apt to cake over after every fall of rain. These defects can be remedied, I believe, by incorporating a large quantity of organic manure with the soil or by dressing it with green manure.

Caravonica cotton.

20. Seed of two varieties of Caravonica cotton (No. 1 and kidney) was received last year from the Inspector General of Agriculture. The seed was sown on 15th Ma, 1906, and the plants were allowed to grow *in situ*. Later on, some plants which had to be removed in course of laying out the farm were transferred to new sites. Altogether there were in the beginning 154 plants which were growing where sown, and 48 plants, which were transplanted. Out of these 202 plants, 120 only now remain, the rest having succumbed to the effects of the last dry season. The surviving plants had to be watered frequently during the dry season to be kept alive. The trees have been plentifully manured with cattle dung. A small proportion of the existing trees have grown into fair-sized bushes and look healthy and vigorous, but the greater number consist of thin long shoots with but few leaves on them. Only one or two bolls were produced during the last hot weather. Some of the trees were found bearing flowers and young bolls in June. So far the plants do not appear to have been affected by any insect or fungous pest.

Fruit trees.

21 The compounds of the houses have been planted out with numerous fruit trees, mostly new to the locality. Some of the trees died after planting. The details of the trees planted are given below—

Description of fruit.	Whence obtained.	Date of planting.	Number planted.	Number died.	Number growing at close of year.
Litchi (Muzaffarpur)	Mr. S. P. Chatterjee, Calcutta.	25th June 1906 ...	40	16	24
Sarbati lime	Ditto ...	4th May 1906 ...	16	2	14
Local lime	Local ...	30th July 1906 ...	16	3	13
Sylhet orange ...	Tropical plantation, Wahjain.	7th June 1906 ...	44	12	32
U Soh-myndong (Khasi lime) ...	Ditto. ...	7th June 1906 ...	25	11	14
Ceylon pine apple ...	Moriani ...	... ...	34	...	
West Indian pineapple (name of variety not known).	Barbados ...	21st December 1906	4	...	4

All available space in the compounds of the houses and the sloping banks of a ravine have been planted out with varieties of plantain of indigenous origin.

The litchi trees with a few exceptions have made good growth. *Sarbati* lime, *U Soh-myndong* and local lime also have grown well, but the orange trees do not look at all thriving. The Ceylon pine-apple is an introduced variety which is found in the gardens of tea planters in Assam. Though known popularly as the Ceylon pine-apple, it is not known what variety it belongs to. It is believed to be identical with the "Smooth Cayenne" of the West Indies. The West Indian pine-apple plants were obtained last year from Barbados through the courtesy and assistance of the Superintendent of the Royal Botanic Garden, Sibpur. Twelve plants belonging to 8 varieties (Smooth Cayenne, Bull-head, La Brea, Maipuri, Black Antigua, Abbaka, Red Spanish and Queen) were sent out from Barbados, but only four out of these reached the Botanical Garden alive. Unfortunately, the plants bore no labels, and it was not possible, therefore, to ascertain which particular variety or varieties they belong to. The four plants arrived at the Farm in the middle of the cold weather and have been kept alive with difficulty. Three of them have trhown out new leaves, while the fourth seems too weak to survive.

Inspection.

22. During the year the Farm was inspected once by the Director of Agriculture and four times by me. Mr. R. S. Finlow, Fibre expert, visited the Farm once in April and a second time in May.

Mention has already been made of Dr. H. Mann's visit to the Farm in April last. The Department is greatly indebted to him for the assistance and advice received from him in connection with the future programme of sugarcane cultivation in the farm.

Expenditure and income of the Farm.

23. The total expenditure of the Farm during the year amount to Rs. 6,831-1-10, out of which Rs. 3,146-3-9 was expended on capital charges and Rs. 1,490-1-6, on the pay and travelling allowance of the establishment. The total income consisting mainly of sale proceeds amounted to Rs. 475-4-7.

24. The establishment of the Farm consists of a Superintendent on a monthly pay of Rs. 100-10—200, a fieldman clerk on Rs. 25-1-8—40, and a peon on Rs. 8. The Superintendent, Babu Rajeswar Das Gupta, was absent on privilege leave for three months from 27th October 1906 to 26th January 1907. Babu Atul Chandra Bagchi held charge of the Farm during the period.

Establishment.

B. C. BASU,

Assistant Director of Agriculture.

Shillong,
The 5th July 1907.

Annual Report of the Shillong Fruit Garden for the year ending the 30th June 1907.

Introductory.

The Fruit Garden and the Upper Shillong Experimental Farm are being worked practically as one concern. They are managed by the same staff and much of the experimental work is common to both. Among the crops common to the two stations are the fruit trees and potatoes. The main object of the Fruit Garden has been the cultivation of fruit trees. Some of the fruit trees imported from abroad were for certain reasons which will be mentioned later on removed to the Experimental Farm. I propose, for the sake of convenience, to deal with the cultivation of all the fruit trees in the report of the Fruit Garden. For a similar reason all experiments in the potato crop will be dealt with in the report of the Upper Shillong Station, where experiments in this crop were commenced several years before the Fruit Garden came into existence.

History and description of the garden.

2. The Fruit Garden commenced work in September 1902. The garden owes its inception to Sir Bampfylde Fuller. It is situated in a village called Umlyngka, 3 miles from Shillong, on the Cherrapunji road, and nearly midway between the town and the Experimental Farm at Upper Shillong. The elevation of the place is about 5,200 feet, *i.e*, about 200 feet higher than the town. It originally comprised an area of 13·4 acres which was acquired by purchase from the Khasia owners at a cost of Rs. 406-12-9. An additional area of a little over 2 acres belonging to the adjoining Government forest has been gradually annexed to the garden. The garden has thus a total area of about 15½ acres. About two-thirds of this area has been brought under cultivation and planted for the most part with fruit trees and mulberry.

The chief object with which the garden has been established is to experiment with various kinds of fruit trees grown in the temperate climates of Europe, with a view to

introduce such of them as may succeed into the hill districts which possess a temperate or semi-temperate climate not unlike that of the warmer regions of Europe. The great drawback in the climate of these districts is the early setting in of the monsoon and the excessive humidity of the soil and the atmosphere caused thereby, which interferes with the ripening of the fruits. Such fruits as pear, apple, plum, peach, apricot, etc., are already grown in and about Shillong, but the fruit in almost every case is of an inferior description. It is hoped that by trying a number of varieties of each species of fruit, one or more may be found that will ripen early or give good fruit in spite of the rains.

The bulk of the fruit trees planted at the garden was obtained from two English firms—Messrs. Bunyard & Co., of Maidstone, and Messrs. Thomas Rivers & Sons, of Sawbridgeworth, Herts. They arrived in the winter of 1902-1903. Small consignments of plants have been obtained from time to time from these firms and from Messrs. Kelway & Sons of Langport, Somerset. Some apples, pears and Spanish chestnuts were obtained in 190 -1903 from the Saharanpur Botanical Garden. Cuttings of several varieties of grape were obtained in 1903 from Kashmir. Several plants have been propagated from seed. These include Cherimoyer, the seed of which was obtained in 1903 from the Government Garden in the Southern Shan States in Burma and tree-tomato and Mountain papaya grown from seed obtained from the Hakgala Garden in Ceylon.

Besides the foregoing, the garden contains small plantations of strawberry, citron, Khasi orange, rhubarb, asparagus and a large variety of squash (*Sechium edule*) procured from Madras.

Although most of the fruit trees planted at the garden in 1903 were found to be growing well, it became soon apparent that the site of the garden, which has a facing to the south and west, was exposed to the high gales which blow from those directions in March, April and May. It was thought desirable, therefore, to remove some of the trees to a place sheltered from the high winds. It was also thought that some of the trees might thrive better at a higher elevation than the Fruit Garden. Some of the trees planted at the garden in 1903 were accordingly trans-

terred to a field in the Experimental Farm at Upper Shillong which is about 700 feet higher than the Fruit Garden and having a north-east aspect, is well sheltered from the high winds which blow from the south and west. Another lot of trees was removed to the new field already mentioned which was made by adding some land from the Government forest adjoining the Fruit Garden. The trees were removed partly in September 1903 and partly in July following.

A stone wall 7 feet high and 228 feet long was made in 1906 to protect a certain number of trees from the high winds. Some of these trees have been planted with a view to train them on the wall, others at a short distance from the wall, so as to enjoy the protection from winds which it is expected to afford. A row of grape vines has been planted at the foot of the wall on the windward side. These are being trained on the wall.

The fruit trees have been planted partly on the natural surface of the ground and partly on artificial terraces cut out of the hill side.

In 1904, a new line of experiment was initiated at the Fruit Garden, namely, the rearing of the European univoltine silk worm. The experiment has been repeated every year since, and each time with successful result. A large portion of the garden has been planted with mulberry, chiefly with a view to obtain plants and cuttings for distribution.

An important part of the work carried on at the Fruit Garden is the propagation by grafting and budding of such fruit trees as have proved successful with a view to their distribution to the public. A large number of stocks have been planted for the purpose. These include stocks of wild apple, wild pear, peach, plum, wild grape and Khasi cherry.

Number of fruit trees at the close of the year.

3. Statement I annexed to this report shows the number and description of fruit trees planted at the Fruit Garden and at the Farm, which remained alive on the 30th June 1907. Statement II shows the number of stocks planted for graft-

ing purpose existing on the same date. The following is an abstract of the two statements :—

Species of trees.	Number of trees standing on 30th June		Number of grafts in nursery on 30th June		Number of stocks for grafting on 30th June	
	1906.	1907.	1906.	1907.	1906.	1907.
1. Apple	29	37	26	67	1,738	1,374
2. Pear	28	66	221	176	1,393	2,572
3. Plum	45	46	...	1	1,825	1,190
4. Peach	9	11	2	19	85	97
5. Cherry	37	37	...	...	289	301
6. Apricot	3	3	...	...	...	...
7. Almond	6	5	...	...	...	...
8. Walnut	17	17	39 (*a*)	26 (*a*)	...	...
9. Fig	48	62	65 (*b*)	4 (*b*)	7	7
10. Grape	141	141	70 (*b*)	470 (*b*)	3	10
11. Spanish chestnut ...	75	75	113 (*a*)	260 (*a*)	...	
12. Cherimoyer	9	6	...	...	...	
13. Tree tomato	5	3	...	350 (*a*)	...	
14. Mountain papaya ...	15	23	14 (*a*)	110 (*a*)	...	
15. Loquat	3	3	...	...	...	
16. Guava	3	5	...	...	...	
17. Khasi orange and citron...	105	105	...	...	...	
18. Gooseberry	13	11	...	...	...	
19. Raspberry	5	13	6 (*c*)	8 (*c*)	...	
20. Currant	40	50	6 (*c*)	...	...	
Total	636	719	562	1,491	4,840	5,551

(*a*) Seedlings.

(*b*) Rooted cuttings.

(*c*) Plants imported from England in 1906.

Character of the season.

4. The only noticeable feature of the season was a long spell of frosty weather in March. It had no appreciable effect except on the peach trees some of which were then in blossom. The result was that few fruits set on these trees.

5. The progress made by each species of tree and the results so far obtained from those which have begun to bear are noted below :—

Progress of the trees.

Apple.—The trees have grown exceedingly well, but so far very few have borne fruit. Last year, two trees of *King of the Pippins* and one of *Allington Pippin* bore one fruit each, but the fruits fell off before reaching maturity. This year again three trees (one each of *Golden Reinette*, *King of the Pippins* and *Scarlet Golden Pippin*) are bearing a few fruits each. Nothing can be said as to the quality of the fruits as yet. Several other trees flowered, but failed to set fruit.

Pear.—The English pear trees made fair to good growth during the year. The Saharanpur trees have grown exceedingly well. Four of these (3 *Keiffer* and 1 *Laconte*) flowered this year for the first time, but none except the *Laconte* set fruit. Mention was made in the last annual report of a delicious variety of pear in the late Mr. Rossenrhodes' garden at Upper Shillong. This tree has been called Rossenrhodes' pear for want of more exact identification. A large number of grafts of this pear have been made with a view to distribution. The stock used is the *Soh-shur* or wild pear of the Khasi Hills.

Plum.—The plum trees have grown unequally. Some of the trees have grown to a good height and although they have been flowering for two or three years past, none of them have yet succeeded in producing fruit. The plum trees have been amongst the worst sufferers from bettles which appear in May and June and defoliate most of the fruit trees in the garden.

Peach.—All the trees have been in bearing for two or three years past. The peach crop this year has been a partial failure in consequence of the late frosts in March. The *Early Silver* trees which give better fruit than others have produced a single fruit this year. On the whole, although the peach trees have been bearing well, the fruit does not approach in quality what is produced in Southern Europe. It is less showy and more or less sour—defects which arise no doubt from the excessive humidity of the climate during the season when the fruits are ripening on the trees.

Cherry.—Most of the cherry trees planted in March 1903 have grown to a big size, but none of them have borne fruit

as yet. The trees which were transferred in 1903 and 1904 to the Upper Shillong Farm and to the new field at the Fruit Garden appear to have suffered greatly from being transplanted a second time, and very few of them have made satisfactory growth. Four trees flowered this year, and three of them produced fruits which, however, dropped off the trees while still young.

Apricot.—The trees are growing slowly.

Almond.—The trees are growing very well. Three trees flowered this year and one produced a few fruits which did not, however, remain long enough to ripen.

Walnut.—Doing well. The trees are not expected to bear for many years yet. There are a few walnut trees in the town, the origin of which is not known. I have seen one of them bearing well. It is expected therefore that walnuts, though very slow in growth, will do well in the Khasi Hills.

Fig.—All but three of the original trees imported from England in 1902 have succumbed one by one to the attack of a borer. The borer is the grub of a large weevil, specimens of which were submitted during the year to the Imperial Entomologist. He was unable to suggest any practicable remedy. The three surviving plants are not expected to live. The fig tree is, however, one which is propagated with ease by means of cuttings. A large number of young trees, have been raised in this way. But unless some means of checking the borer be found, it is to be feared these trees too will fall a prey to the pest sooner or later. Many of the young trees are in bearing.

Grape.—The grape vines have suffered greatly from powdery mildew (*Oidium tuckeri*) as well as from beetles. The English vines have proved particularly susceptible to mildew. They were planted in 1903 under the eaves of the plant house. Repeated sprayings with Bordeaux mixture and Potassium sulphide have failed to check the blight on these vines. Three out of the six original plants were trained on the outside of the wall of the house, and the remaining three remained inside. Those on the outside suffered less from mildew; but, on the other hand, owing to the exposed situation of the house, they suffered greatly from the high winds which blew in the spring. Two of the three outside plants were removed last year to a newly-terraced field in the Fruit Garden. It has been observed that vines planted out in the open air are much less liable to mildew. I

thought it, therefore, desirable to abandon the old plan of planting grapes under the eaves of a house, and substitute open air planting in its place. The four vines remaining in the plant house will be transferred to the new terraces next spring.

The Kashmir grapes were planted originally in a strip of cleared land running through jungle. The plants suffered every year from beetles which came from the adjoining jungles and ate up the leaves, leaving little strength to the plants to grow and mature the canes. It was sought at first to protect the vines by covering them with netting cloth, but the remedy proved expensive, and in the case of the larger plants impracticable. All the plants had therefore to be removed to new sites. Some of them were planted in the spring of 1906 in a border along the south side of the stone wall, and the rest were transferred in March last to a newly-terraced field prepared last year. The vines planted against the stone wall have suffered much from the high winds in spring; but they are free from mildew. The plants removed to the new terraces have suffered to some extent from beetles, but I believe not to the same extent as in their old sites. They are protected well from high winds and so far no mildew has appeared on them.

Several of the English and Kashmir vines are now in bearing. Two plants of English grape No. 4 are bearing several large bunches of grapes. They have been attacked by mildew and are being treated with dilute sulphuric acid and flowers of sulphur. It is hoped some good fruits will be obtained.

A history of the Shillong black grape was given in my last report. This grape has become popular in Shillong. The variety is extremely prolific and remarkably free from fingus disease, but the fruit is somewhat sour. We have several vines of this grape at the Fruit Garden. Two plants, three years old, are now covered with fruits.

Spanish chestnut.—The old chestnut trees, now some 30 years old, have proved somewhat disappointing. They flower profusely every year, but yield comparatively few nuts. Most of the capsules turn out to be empty. Last year the aggregate yield of nuts from 42 trees amounted only to 20 seers. I am not sure if anything will be gained by distri-

buting Spanish chestnut trees in the Khasi Hills. The trees flower in May and June, and it is probable that the heavy rains which set in that time interfere with the pollination of the flowers.

The young chestnut trees obtained in 1903 have suffered very badly in the past from the beetle pest, but they are making fair growth now. The beetles were kept in check this year by repeated sprayings with kerosine and crude oil emulsions.

Cherimoyer.—The trees have made exceedingly good growth. They need protection from frost.

Tree tomato.—This tree too needs protection from frost. Two trees bore fruit last year, and some are in bearing now. The ripe fruit can be eaten uncooked and makes a good stew with sugar. The tree or rather shrub begins to bear in the second year and is grown very easily from seed. I believe the fruit will come to be regarded as an acquisition to the Khasi Hills.

Mountain papaya.—The trees are growing well and all the female trees are now bearing fruits. The Mountain papaya cannot compare as a dessert fruit with the common papaya, but it is a good fruit for stewing. The fruit is of a small size, and has an agreeable flavour not unlike that of a melon.

Loquat.—Growing very well. There are loquat trees in Shillong, but they are found to bear very scantily. It remains to be seen how our trees will behave.

Guava.—Growing very slowly.

Khasi Orange and Citron.—The Khasi orange is an exceedingly slow grower in the climate of Shillong. The trees at the Fruit Garden have not made much growth. The citron plants on the contrary are growing freely, and some of them have flowered for the first time this year and are expected to produce some fruits.

Bush Fruits.—These are the gooseberry, the raspberry and the currant. There is little hope of any of these succeeding in the open air in the climate of Shillong. Up to the setting in of the rains, the bushes remain healthy and grow well, but they become diseased as soon as wet weather comes. The young shoots die back and growth is wholly stopped for the rest of the year. Spraying and cutting back the diseased wood have been tried as remedial measures, but

to no apparent effect. The bushes are looking more and more diseased every year, and many have wholly died out.

Treatment of fruit trees; root pruning.

6. The chief operations connected with the cultivation of fruit trees consisted in manuring and pruning the trees during the winter, and in the application of various remedies for insect and fungus pests which attack them. The larger trees were not manured at all last year. The only trees manured were Spanish chesnuts, walnuts, grapes and bush fruits. The manure used was old cowdung. Some of the weaker plants were treated with liquid manure in the spring months. Although most trees have made good growth, few of them have as yet come into bearing. I attribute this unfavourable result partly to the excessive use of manure in the past and partly to the forcing nature of the climate which tends to produce an undue amount of vegetative tissue at the expense of the reproductive parts. I propose, therefore, to restrict the use of manure in future.

Very little top pruning was done during the year, except on the grape vines which require to be annually pruned. Root-pruning was tried last year on several apple, pear, cherry and plum trees with the object of checking the excessive production of wood and of stimulating the trees to flower and fruit. Eleven trees were root-pruned, namely, 2 apples, 6 cherries, 2 plums and one pear. Out of the eleven trees, four produced blossom (2 apples, one cherry and one pear). Only one (a cherry) was able to set fruit, but the fruits dropped off long before they were due to ripen. Root-pruning is being carried on vigorously this year. I think the operation was not performed with sufficient severity to check the growth of wood, all the trees which were root-pruned last year having made very good growth again this year.

Battle against insects.

7. Mention was made in my last report of the hordes of beetles and weevils which breed in the neighbouring forests and waste lands and invade the fruit trees in May and June, and of our want of success in fighting them. The trees most attacked are plums, cherries, apricots, almonds, walnuts and Spanish chestnuts. Various insecticides and traps had been tried in previous years, but with no appreciable result. The problem we had to solve was not how to kill the insects (because as fast as they are killed they are replaced by new arrivals), but to find some means whereby the insects can

be kept off the trees. The use of some substance which by its offensive smell would prevent the insects from settling on the trees was indicated. It was also clear that to be effective the application should be repeated at frequent intervals. Acting on these ideas, we had a number of strong smelling substances tried in May and June this year. Side by side with these, several poisonous vegetable and mineral substances also were tried. The substances tried were—

(1) Lead arseniate—½ tea spoonful to 2½ teapoonfuls of lime, 5 tea spoonfuls of jaggery and 10 seers of water.

(2) Kerosine emulsion made by boiling 1½ seers of kerosine with ½ chittack of barsoap and 10 chittacks of water, till the oil is completely emulsified; then diluting the mixture with 19 seers of water.

(3) Crude oil emulsion 2½ chittacks of crude oil emulsion diluted with 10 seers of water.

(4) Asafœtida solution. One tola of asafœtida with two tolas of gur and 20 seers of water.

(5) Phenyle mixed with ashes (1 to 20).

(6) Kerosine mixed with ashes (1 to 20).

(7) Lemon grass oil mixed with ashes (1 to 16).

(8) Lemon grass oil in water (2 per cent strength).

(9) *Jaiur* decoction (one of *Jaiur* to 20 of water).

(*Jaiur* is a very pungent spice used by Khasias as a substitute for pepper.)

(10) Decoction of *Sawiah byscin*, a vegetable poison prepared by boiling the vegetable in 20 times its weight of water.

The trials commenced on the 15th May and continued up to the end of June when the beetles finally disappeared. A number of trees were marked out for the trial of each insecticide. During the first week the applications were repeated every evening. At the end of the week, it became quite evident that six out of the nine insecticides had no appreciable effect in checking the ravages of the insects and their use was accordingly discontinued. The three substances which proved useful were kerosine emulsion, crude oil emulsion and phenyle mixed with ashes. The last (phenyle) did not seem to be quite as good as the other two; it burned the tender leaves of the trees to some extent. After the first week, these three insecticides were applied

on separate lots of trees once every other day instead of daily. The trees so treated suffered very much less from the insects. The protection was not so complete as one would wish, but it was sufficiently so for our purpose. It should be remembered, however, that these remedies, to be effective, should be applied if not daily every at least once two days. In future we shall use either kerosine or crude oil emulsion. The two are about equally effective. Perhaps the latter would be the cheaper of the two. This point remains to be seen.

Fungous disease.

8. The chief fungous diseases which have caused trouble are a fungus which causes the young wood of the bush fruits to die back and the powdery mildew on the grape vine. No remedy has yet been found for the *die back* disease of the bush fruits. The powdery mildew on the grape vine has been particularly injurious to the English grapes planted under the eaves of the plant house. Repeated applications of potassium sulphide and Bordeaux mixture have failed to check the disease. Experience gained at the Fruit Garden and in my own garden at Laban shows that stagnant air and want of sun are the condition which induce the disease and that the disease can be kept in abeyance by planting out the vines in the open where they can enjoy the full benefit of the sun and the air has full play. Some of the English vines which had been suffering badly from mildew were accordingly removed to an open site.

All the vines were sprayed with Bordeaux mixture last winter when the buds were in a dormant state. The vines in the plant house were affected nevertheless with mildew. The subsequent treatment of the diseased plants has consisted in spraying the foliage with very dilute sulphuric acid (3 parts of acid in 1,000 parts of water) and dusting the moistened leaves with flowers of sulphur. The result of the treatment seems so far to be encouraging.

Strawberry.

9. Four varieties of strawberry were cultivated during the year at the Fruit Garden. These are *Aprikose*, *Louise Gautier*, *Givoz Late Prolific* and *Sir John Paxton*. *Aprikose* is a large handsome fruit of a deep scarlet colour when ripe. *Louise Gautier* is a large irregularly shaped fruit, colour almost white with a pinkish tinge; the plant bears exceedingly well, but the fruit is somewhat watery

in taste. The other two kinds yield fruit of medium size and, of a deep scarlet colour. Sir John Paxton which proved fairly prolifically last year (1906) dwindled down this year and give little fruit. This variety has therefore been discarded.

The total area under strawberry now is 772 square yards, or a little under one-sixth of an acre. Out of this area 430 square yards yielded fruit last year and the remainder is land planted newly towards the close of the year. The 430 square yards gave a total yield of 61 seers 10 chittacks of fruit which were sold for Rs. 92-5-9. The sale price was Re. 1-8-0 per seer. The acreage yields would work out to 17 maunds, 14 seers of fruit valued at nearly Rs. 1,040. The cost of cultivation, exclusive of the cost of cattle dung used, amounted to Rs. 26-13-0 which works out to about Rs. 290 per acre.

A record was kept this season(1907) of the yield of fruit of each of the three varieties of strawberry which now remain. They occupied adjacent plots of land and received the same treatment. The object was to see how they compared in respect of yield. The particulars of the trial were as follows :—

Variety.	Area.	Yield.	Value.	Approximate yield per acre.	Approximate value of yield per acre.
	Sq. yds.	Sr. Ch.	Rs. a. P.	Mds.	Rs.
Louise Gautier .	54	26 9	39 14 0	59·5	3,570
Aprikose ...	40	6 14	10 5 0	21	1,260
Givoz Late Prolific ...	50	16 10	17 6 9	40	2,400

The acreage yields are exhibited for convenience of comparision. The results obtained from such small areas as 40 or 50 square yards cannot be safely used in calculating probable yields from an acre of land, but they leave no doubt that it will pay market gardeners of Shillong very well to grow strawberries for local sale.

Other crops grown in the Fruit Garden.

10. Several species of vegetables new to Shillong have been successfully grown in the Fruit Garden. These are rhubarb, asparagus, a large variety of squash (*Sechium edule*) and three varieties of American sweet potatoes

The rhubarb and asparagus plantations continue to yield well.

The results obtained last year are shown below —

	Rhubarb.	Asparagus.
Area plucked ...	493 sq. yds.	220 Sq. yds.
Yield	2 mds. 4 srs.	1 md. 6 srs. 8 ch.
Value of yield .	Rs.12-0-0	Rs. 34-14-0
Cost of cultivation exclusive of cost of cattle dung	„ 8-1-0	„ 28-2-0
Net profit ...	„ 33-15-0	„ 6-12-0

The plantations are being gradually extended.

The large variety of squash was introduced in 1904. There were 41 plants last year at the Fruit Garden. For some reason the vines did not bear well last year. Only 150 fruits were obtained, out of which 102 were distributed as seed.

Three varieties of American sweet-potato of which seed was originally obtained from the Inspector General of Agriculture have been cultivated at the Farm since 1904. During the year under report a comparative trial was made between the three varieties and two varieties of Khasi sweet potato. For want of sufficient seed, the experiment was made on very small areas. Each variety occupied two beds of 1/160th of an acre. One of the beds was planted with unrooted cuttings of the vine, and the other with cuttings which had already taken root. The former were planted on 23rd June and the latter on 29th idem. The crop as usual died as soon as frosty weather came in November. The tubers were dug out in January. The only manure used was cowdung at the rate of 800 baskets to the acre (a basket contains about 15 seers of dung).

The yields were as follows :—

Variety.	From unrooted cuttings.	From rooted cuttings.	Average yield of two series	Yield per acre.
	Seers.	Seers.	Seers.	Maunds.
1. Nonsimmond ...	13½	22	17⅝	70½
2. Virginia ...	15⅓	27	21¼	85
3. New Jersey ...	15	19½	17¼	69
4. Khasi (early variety) ...	25½	35	30¼	121
5. Khasi (late variety) ...	36	33	34½	138

None of the American varieties came up in yield to the indigenous varieties. The tubers of the former have a bright yellow mealy flesh and are in these respects superior to the country sweet potato which has a white waxy flesh and is perhaps less sweet.

Rhubarb and asparagus demonstrations.

11. Efforts to introduce the rhubarb and asparagus into local cultivation were continued during the year. Leaflets on the cultivation of rhubarb, asparagus and squash were circulated and small quantities of seeds and plants distributed free of charge. Mention was made in my last annual report of two demonstration of the cultivation of rhubarb having been started in the neighbourhood of Shillong. They are being made in the gardens of two educated Khasia gentlemen who have given the land and undertaken to supervise the cultivation. They are to be paid all expenses of cultivation till such time as the plantations begin to yield, and will be allowed whatever sale proceeds accrue therefrom. In all about an acre of land has been prepared for the cultivation by each of these persons. Seed was sown in special seed beds in the rains of last year, and the seedlings transplanted in the field last spring. Unfortunately, the seed germinated so scantily that the plants actually obtained fell far short of the number required to plant out the land. On the areas which remained unprovided with plants, fresh seed was sown at suitable intervals with the idea of letting the plants grow *in situ*, but this seed too turned out to be equally bad. The total number of plants now on the ground is 1,158 in one place and only 104 in the other. These plants are growing well. New seed has been indented for from England, and will be sown on the land that now remains vacant. Up to the close of the year under report, a sum of Rs. 281-8-6 was spent on these two demonstrations. One of the two demonstrators has planted out a small area (280 square yards) with asparagus. The plants which are now a year old are growing well.

Sericultural experiment.

12. The experiment in the rearing of the European univoltine silk worm was repeated for the fourth time at the Fruit Garden in the spring of this year and proved quite as successful as in the past three years. This year's experiment has been distinguished from those of previous years by

the fact that locally raised seed was used for the first time this year, and the result of the use of this seed was as successful as one could desire. It is reported that none of the attempts made in Kashmir at rearing the European univoltine silk worm from eggs produced in Kashmir itself have proved successful, the worms having died in every case from flacherie. This fortunately has not been the case in our experiment, and what is more the cocoons raised from locally produced seed have turned out as large and fine as those obtained from seed newly imported from France. This will appear from the detailed account of the experiment given below.

This year three different lots of eggs were used. These were —

(1) Var seed—local

(2) Ditto—newly imported from France and

(3) Italian yellow —local.

The two lots of local seed were raised at the Fruit Garden from the cocoon crop of 1906. The female moths which laid the eggs were examined by the late Mr. N. G. Mukerjee and found to be practically free from pebrine. As a further safeguard against pebrine, the eggs of all moths which died within 12 days from the date of laying (which allowed more than 30 days from the last date of spinning) were thrown away and only those from moths which showed a longer duration of life were preserved for use this year.

Four year's experience has conclusively shown that the winter of Shillong is cold enough for the proper hibernation of the eggs of the European silk worm, though at one time it was feared not to be so.

A departure was made in this year's experiment from the practice hitherto followed in respect of—

(1) the hatching of the eggs;

(2) the heating of the house and;

(3) the killing and drying of the cocoons.

In former years, the eggs were hatched in an incubating box of which the temperature was maintained by means of a lamp between 70° and 80° F. This year no such apparatus was used. The seed was tied in a cloth and a man carried it under his clothes for some days. The heat of his body caused the worms to hatch out This process of incubation answered

just as well as the incubator, the worms hatched out with the usual degree of evenness and regularity, the whole process of hatching out being completed in five days (from 31st March to 4th April). Each lot of eggs and of the worms which came out was of course kept separate.

In former years, the rearing house used to be heated by a stove which raised the temperature by about 5 degrees. This year no stove was used, and although two small *angutis* were kept burning, the rise of temperature was so little as to be scarcely appreciable. The temperature of the house varied from an average of 63° in the early morning to an average of 67° in the afternoon. It was about 6° lower than the average of the previous year. The result was that the worms took a longer time to reach maturity. The period from commencement of hatching to commencement of spinning varied in the different lots from 41 to 46 days, while in 1906 the duration of larval life varied from 36 days to 42 days.

In former years the cocoons were stifled with steam and then dried in a hot case, the temperature of which was kept between 80°F and 100°F. The drying process was a very slow and tedious one, and took many days to complete. This year a small stone-built oven very similar to what is used by bakers was used in killing and drying the cocoons. The operation took only three hours. The heat was such that one could just put his hand into the oven without getting burnt.

A smaller quantity of worms was raised this year than in previous years. The experiments of past years having proved successful, there was no special object in repeating it this year beyond using it as a demonstration and ascertaining whether locally raised eggs could be used with success. It is a matter of great regret to me that the Superintendent who conducted the experiment failed to keep an accurate record of the quantity of seed he used. He started with half a tola of seed of each lot and when he found that he had too many worms he threw some away, thus depriving himself of the means of ascertaining what proportion of seed was actually reared into cocoons. Naturally he preferred for rejection those worms which exhibited any signs of weakness. The only point on which our information remains incomplete is the yield of cocoons from a given weight of seed. I shall endeavour to supply this datum from next year's trial.

The worms were fed on the leaf of two different species of mulberry known botanically as *Morus atropurpurea* and *M. indica*. The former is called by us as the " big leaf " and the latter the "small leaf" mulberry. Each kind of worm was divided into two lots, one of which was fed on the "big leaf" and the other on the "small leaf" mulberry. Thus there were 6 distinct lots *viz*:—

Lot No. 1 Var.— local, fed on big leaf.
2 Var.— local, on small leaf.
3 Var.— newly imported, fed on big leaf.
4 Var.— newly imported, fed on small leaf
5 Italian yellow—local, fed on big leaf.
6 Italian yellow—local, fed on small leaf.

It will be seen from the results noted below that the cocoons raised on the " small leaf" were larger in weight and contained more silk than those reared on the big leaf. This result lends corroboration to that obtained last year from the trial of the two species of leaf

The worms were unusually free from disease. Thirteen worms in all from the two lots of newly imported var seed died before spinning, seven from *Grasserie* or *Court*, and six from what appeared to me to be pebrine. These six worms have been sent to the Bengal silk expert, Mr. A. K. Ghosh, for examination. There was no sign of pebrine in the four lots raised from local seed. Only five worms from the two lots of local Var and three from the two lots of Italian yellow (local) died from *Grasserie* and *Court*.

These results may be considered as eminently satisfactory.

The total outturn of green cocoons was as follows :—

Lot No.	Name.	Kind of leaf on which fed.	Number of cocoons.	Weight of green cocoons.	Remarks.
				Srs. ch.	
1	Var, local ...	Big leaf ...	661	1 7·4	The total yield of floss was 3·4 chittaks.
2	Ditto ...	Small leaf ...	662	1 9·6	
3	Var, new ...	Big leaf ...	883	1 12·0	
4	Ditto ...	Small leaf ...	552	1 4·6	
5	Italian yellow local	Big leaf ...	825	1 12·8	
6	Ditto ...	Small leaf ...	1,153	2 12·2	
		Total ...	4,691	10 10·6	

Out of the crop, 100 picked cocoons of local Varand the same number of local Italian yellow were kept apart for seed purposes. The moths began to emerge some days after the last date of spinning. The eggs thus obtained will produce the second generation of worms raised from local seed. The female moths have been sent to Mr. A.K. Ghosh for examination as to freedom from disease. The remaining cocoons were killed and dried in an oven as already described to very nearly one-third of their original weight.

A careful determination was made of the average dimensions, weight and silk content of each of the six lots of cocoons within one to three days after the cocoons were plucked. These are exhibited in the following table The averages were determined by measuring the aggregate length and width at the middle of 20 cocoons picked at random and their total weight before and after removing the chrysalids and moulted skins within and dividing these aggregates by 20.

Table showing the result of examination of green cocoons.

Lot No.	Name.	Kind of leaf on which fed.	Average dimensions.		Average weight (grammes).	Average weight of each shell of silk (grammes).	Percentage of shell on weight of green cocoons.
			Length (millimetres).	Width (millimetres).			
1	2	3	4	5	6	7	8
1	Var (from our own seed) ...	Big leaf ...	37·55 (1·48 inch) ...	19·05 (·75 inch) ...	2·038 (·175 tola) ...	·291 (·025 tola) ...	14·33
2	„ (ditto)...	Small leaf ...	40·13 (1·58 inch) ...	21·18 (·834 inch) ...	2·365 (·203 tola) ...	·326 (·028 tola) ...	13·78
3	„ (new seed from Franco)	Big leaf ...	36·30 (1·43 inch) ...	18·567 (·731 inch) ...	2·038 (·175 tola) ...	·279 (024 tola) ...	13·76
4	„ (ditto)...	Small leaf ...	37·55 (1·48 inch) ...	18·948 (·746 inch) ...	2·306 (·198 tola) ...	·338 (·029 tola) ...	14·64
5	Italian yellow (from our own seed).	Big leaf ...	35·05 (1·38 inch) ...	18·443 (·72 inch) ...	2·073 (·178 tola) ...	·326 (·028 tola) ...	15·72
6	Ditto ditto ...	Small leaf ...	36·80 (1·43 inch) ...	19·354 (·762 inch) ...	2·492 (·214 tola) ...	·349 (·030 tola) ...	14·00

N. B.—1 tola=11·649 grammes.

1 inch=25·4 milli metre.

The effect of the kind of leaf on the size and weight of the cocoons is well brought out in the table. It is seen, as was also found last year, that cocoons raised on the small leaf are larger and heavier than those raised on the big leaf. The difference in favour of the small leaf is uniformly marked in all the three series in which small leaf and big leaf were contrasted against each other.

Comparing lots 1 and 2 with 3 and 4, respectively, it will be seen that the cocoons produced from local seed were in no way inferior to those obtained from newly-imported French seed; if anything, they were larger in size and slightly heavier in weight. And what was more remarkable was that they beat the best lots of Var and Italian yellow cocoons grown in 1906 from which the seed for this year's crop was obtained. The following figures would shew this :—

— —	Var., 1906.	Var. (local), 1907.	Italian yellow, 1906.	Italian yellow (local), 1907.
	mm.	mm.	mm.	mm.
Average length	38·9	40·13	31·2	36·30
„ width	19·3	21·18	17·4	19·35
	Gr.	Gr.	Gr.	Gr.
„ weight of green coccon	1·993	2·365	1·925	2·492
„ weight of silk content (weight of shell).	·282	·326	·291	·349

It is possible that the 20 cocoons of each lot which were picked out for the determination of average dimensions and weight might not have been quite typical of the lot from which they were taken. Nevertheless the quality of this year's cocoons shows such an uniform advance over that of last year's that one can safely conclude that the seed if it has not actually improved has at all events undergone no deterioration from being produced locally.

The cocoons of the last crop have not yet been valued. Those of the crop of 1906 were submitted for examination and sale to a well-known sericultural authority, M. DeL' Arbousset of Alais in France, who pronounced very favourably on the quality of the cocoons. In respect of the proportion of reeled silk which they yielded, they did not appear to be by any means inferior to the average cocoons produced in France.

The cocoons were mildewed when they reached M. DeL' Arbousset. This was the only defect complained of. The defect arose apparently from the absence last year of any means of drying the cocoons with sufficient rapidity, and has been remedied this year by heating the cocoons in an oven, the entire operation taking only three hours instead of a fortnight or so as in previous years.

The total quantity of cocoons sent to M. DeL' Arbousset for sale was 7·980 kilograms. He had the cocoons reeled and the silk which weighed 2·270 kilos sold for 113·50 francs. Deducting 13·60 francs for cost of reeling, the net amount realised by sale was 99·90 francs which meant 12·50 francs per kilo of cocoons. In Indian weight and money, this means Rs. 7 per seer (1 seer = ·932 kilo and 1 franc = 9·6 annas). As the cocoons were dry, the price reduced to their equivalent of green cocoons, taking the latter to be three times the weight of the former, would be Rs. 7 divided by 3 or Rs. 2-5-4 per seer. I scarcely think a better valuation could be looked for.

The above refers to M. De L'Arbousset's valuation of the cocoons produced in 1906. His report on the cocoons of 1905 which was quoted in my last report was almost equally encouraging. He has expressed the opinion that sericulture should have a bright future in the Khasi Hills. A report on the sericultural work done at Shillong was sent last year to Sir Thomas Wardle, President of the British Silk Association. He too was of opinion that the experimental stage of silk-worm rearing in the Khasi Hills had been passed, and it was time "to go into the thing thoroughly" as he put it. Sir Bampfylde Fuller at whose instance the sericultural experiment was undertaken at Shillong four years ago also held the same view.

No progress has, however, been made as yet in introducing the new industry into the Khasi Hills. In 1905, seven Khasias took seed from the Fruit Garden and obtained an aggregate crop of 23 seers of green cocoons which were all bought up by the Department at the fixed price of Rs. 2-8 per seer. In spite of this generous treatment, none of these men took any seed the following year (1906), but one new man took two ounces of seed. He failed, however, disastrously for want of knowledge of the right method of rearing. In the present year not a single person came forward to take seed from the Fruit Garden. It is clear that before the

Khasias can be expected to take to silk-worm rearing, an industry of which they have at present no knowledge, they should be provided with facilities for acquainting themselves with the technicalities of the industry as well as with its difficulties and the means of overcoming them. With this object, the Director of Agriculture has recently submitted a proposal to Government to send some Khasia youths for a course of training at the Rajshahi Sericultural school and to assist them on their return with moderate grants of money on condition of their engaging in sericulture. The orders of Government are awaited.

Silk-worm gut.

13. A new product, silk-worm gut, was prepared experimentally during the year at the Fruit Garden. The experiment was made at the suggestion of Mr. H. Weir of the Kalline tea estate in Cachar. The directions for preparing the gut were taken from a book called *The Rod in India* by Mr. H. S. Thomas of the Madras Civil Service. The worms were collected from the feeding trays just as they commenced to spin. They were pickled for a night in a mixture of equal quantities of vinegar and water. They were taken out and opened by nipping off the heads, and the yellowish green silk coils, of which there were two in each, were removed and stretched out as far as they would go without breaking. The strands were kept stretched by having their ends placed in slits on pieces of card board or on sticks of ekra reed and exposed to the sun for a few hours to dry. They were treated again to remove a yellow substance which remained adhering to the gut. The treatment consisted in boiling the strands for a few minutes in a weak solution of soap and in drawing them afterwards through a pledge of cotton held between the finger and the thumb, which removed the yellow coating. They were then replaced on the boards or sticks to dry.

One hundred and ten worms were taken for the experiment, out of which about180 strands of gut were obtained Samples of the gut have been sent through the Director General of Commercial Intelligence to England for valuation. Some specimens were sent to Mr. Weir who examined them along with specimens of imported gut which he had with him. The gut we sent him was much thinner, but it was longer and of good colour. Mr. Weir thought that for a first experiment the trial was a remarkably successful one.

Mulberry cultivation.

14. The mulberry plantation on the Fruit Garden was extended by nearly an acre during the year under report. The total area under mulberry at the close of the year was nearly three acres; besides which there are 246 trees planted along the borders of the garden. All are growing well.

The efforts to popularise the cultivation of mulberry among the Khasias are being continued, but so far the people have shown little eagerness for the pursuit of sericulture and the planting of mulberry. During the year 440 rooted cuttings of mulberry were distributed to five Khasias.

Distribution of seeds and plants.

15. The following seeds and plants were distributed gratis during the year:—

—	Number or quantity.	Number of persons supplied.		
		Khasias.	Others.	Total.
1	2	3	4	5
Asparagus plants	319	1	8	9
„ seed	1 oz.	2	...	2
Rhubarb plants	23	...	3	3
„ seed	6 oz.	3	1	4
Walnut plants	11	4	1	5
Fig cuttings	13	4	2	6
Spanish Chestnut plants ...	42	9	4	13
Squash seed fruits ...	96	25	8	33
Pear grafts	11	4	2	6
Pear cuttings	25	...	2	2
Apple grafts	7	4	1	5
Plum grafts	6	...	1	1

—	Number of quantity.	Number of persons supplied.		
		Khasias.	Others.	Total.
1	2	3	4	5
Grape rooted cuttings ...	37	6	5	11
Mulberry rooted cuttings ...	440	3	2	5
Mountain papaya plants ...	17	4	2	6
Strawberry suckers ...	336	...	8	8
American sweet potato ...	18 srs.	3	3	6
Tree-tomato plants ...	10	...	1	1
Tree-tomato seed	2 oz.	...	2	2
Silk worm eggs	½ „	...	1	1

Besides the above, the following ornamental trees were supplied free to residents of Shillong—poplar 100, plane 6 and Japanese cherry 2. Eighteen plants of Japanese cherry and one of Japanese chestnut were obtained last year through the British Embassy from Japan. Japanese cherry is intended solely as an ornamental tree. The chestnut tree was sent by the Embassy unasked.

Agricultural meeting.

16. As in the previous year, a meeting of representative cultivators from different parts of the district was held at the Fruit Garden for disseminating a knowledge of the work carried on at the several agricultural stations in the Khasi Hills. The meeting came off on the 24th August 1907, and out of 68 persons invited, 41 were actually present. Among the visitors was Raja Kine Singh, Siem of Nongkhlaw, who evinced a lively interest in the cause of agricultural improvement, particularly with reference to potato, fruit trees and the breeding of Patna cattle. The meeting was attended by the Director of Agriculture and Mr. Herrick Singh, Superintendent of Experimental Farms, who took the visitors over

the Fruit Garden and explained in detail the object of each experiment in progress. The lines of work we have been following, and the results so far achieved at the other two agricultural stations in the Khasi Hills (*viz.*, Upper Shillong Farm and the Tropical Plantation) were also explained to them. It was a source of great regret to me that I could not myself attend the meeting for certain unavoidable reasons.

Receipts and expenditure.

17. The receipts of the garden during the year amounted to Rs. 207-15-3, against Rs. 146-15 in 1905-06. The expenditure amounted to Rs. 2,065-8-5. This excludes Rs. 720, being the pay of the Superintendent of the Experimental Farm in the Khasi Hills, who lives on the Fruit Garden but has, besides, to supervise the working of the agricultural stations at Upper Shillong and Wahjain. It is also exclusive of the pay of the fieldman clerk, who deals with the accounts and correspondence of all the three stations and of two apprentices employed at the Fruit Garden and the Farm. These items amount respectively to Rs. 200 and Rs. 232-6-10. Inclusive of the pay of these officers, the *total* expenditure during the year amounted to Rs. 3,217-15-3, against an expenditure of Rs. 3,047-3-3 in the previous year.

B. C. BASU,

Assistant Director of Agriculture,
Eastern Bengal and Assam.

Shillong,
The 25th July 1907.

STATEMENT I.

Showing the number and description of fruit trees at the Fruit Garden and the Experimental Farm at the close of June 1907.

pecies of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
	Golden Reinette ...	England ...	September 1903 ...	...	1*	
			July 1904 ...	1*	...	
	Kerry Pippin ...	Ditto ...	Ditto ...	1*	...	
	Cox's Orange Pippin ...	Ditto ...	September 1903 ...	...	1*	
	Ribston Pippin ...	Ditto ...	Ditto ...	...	1*	
			July 1904 ...	...	1*	
	King of Pippins ...	Ditto ...	September 1903 ...	...	1*	
		Ditto ...	July 1904 ...	...	1*	
		Locally grafted ...	1906 ...	2	...	Planted under the wall.
	Scarlet Golden Pippin ...	England ...	September 1903 ...	...	1*	
			March 1903 ...	1	...	

Apple ...	Thomas Rivers ...	Ditto ...	July 1904 ...	...	1*	
	Allington Pippin ...	Ditto ...	Ditto ...	1*	1*	
	Braddik's Nonpareil ...	Ditto ...	Ditto ...	...	1*	
	Manington's Pearmain...	Ditto ...	Ditto ...	1*	1*	
	Devonshire Quarenden ...	Ditto ...	Ditto ...	...	1*	
	Newton Pippin ...	Saharanpur ...	March 1903 ...	3	...	
	Blenheim Orange ...	Ditto ...	Ditto ...	3	...	
	Early Harvest ...	Ditto ...	Ditto ...	2	...	
	Freeman's apple ...	Old Model Farm ...	About 30 years old	...	4	Called Freeman's Apple after the name of the Superintendent of the Old Model Farm.
		Locally grafted ...	1898 ...	...	1	
		Ditto ...	1901 ...	...	5	
			Total ...	15	22	

N. B.—The trees marked with asterisks were transferred from the terraces in the Fruit Garden where they had been planted in March 1903.

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
	Besides, there were the following number of new grafts not yet planted in permanent stations.					
	Ribston's Pippin ...	Grafted ...	February 1907 ...	...	1	
	Cox's Orange Pippin ...	Ditto ...	Ditto ...	...	3	
	Early Harvest ...	Ditto ...	February 1905 ...	1	...	
	King of the Pippins ...	Ditto ...	March 1907 ...	...	1	
Apple—*concld.*	White Apple from Rossenrhode's.	Ditto ...	„ 1906 ...	7	...	
			„ 1907 ...	47	5	
	Scarlet Golden Pippin ...	Ditto ...	Ditto ...	...	2	
			Total ...	55	12	
	Souvenir du Congress ...	England ...	September 1903 ...	...	2*	

Pear ...	Beurre D'Ammanlis ...	Ditto ...	March 1903 ...	1	...	
			September 1903 ...	...	1*	
	Clap's Favourite ...	Ditto ...	Ditto ...	...	2*	
	Doyenne du Comice ...	Ditto ...	Ditto ...	...	1*	
			July 1904 ...	1*	...	
	Marie Louise ...	Ditto ...	Ditto ...	1*	1*	
	Duchesse D'Angouleme .	Ditto ...	Ditto ...	1*	1*	
	Conference ...	Ditto ...	Ditto ...	1*	1*	
		Locally grafted ...	March 1907 ...	2	...	
	Louise Bonne of Jersey	England ...	July 1904 ...	...	1*	
	Emile D'Heyat ...	Ditto ...	Ditto ...	1*	1*	
	Laconte	Saharanpur ...	March 1903 ...	4	...	
	China	Ditto ...	Ditto ...	3	...	
	Keiffer	Ditto ...	Ditto ...	3	...	
	Kitchen Pear ...	Model Farm ...	30 years old ...	...	2	These have existed since the Old Model Farm.
	Rossenrhode's Pear ...	Locally grafted ...	March 1906 ...	5	...	
		Ditto ...	„ 1907 ...	30	...	
			Total ...	53	13	

N. B.—The trees marked with asterisks were transferred from the terraces in the Fruit Garden where they had been planted in March 1903.

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
		Besides, there were the following grafts not yet planted out :—				
Pear—*concld* ...	Rossenrhode's Pear ...	Locally grafted ...	February 1905 ...	...	26	
			„ 1906 ...	1	...	
			„ 1907 ...	6	...	
		Budded ...	June 1906 ...	...	58	
		Ditto ...	July 1906 ...	20	...	
		Ditto ...	June 1907 ...	...	7	
	Keiffer	Grafted ...	February 1905 ...	1	2	
	China	Ditto ...	Ditto ...	1	...	
	La Conte	Ditto ...	Ditto ...	4	...	
	Beurre D'Ammanlis ...	Ditto ...	Ditto ...	...	1	
	Doyenne du Comice ...	Ditto ...	Ditto ...	...	2	
			February 1907 ...	3	...	

	Marie Louise ...	Ditto ...	February 1905 ...	...	4
			„ 1907 ...	4	...
	Conference ...	Ditto ...	„ 1905 ...	...	2
			„ 1907 ...	5	...
	Emile D'Heyst ...	Ditto ...	„ 1905 ...	...	5
	William Bonchretien ...	Budded ...	1905	...	1
	Kitchen Pear ...	Grafted ...	5 years old ...	...	11
	Unknown	Budded ...	1905	2	...
			Total ...	47	119
Plum ...	Mallard	England ...	March 1903 ...	1	...
			July 1904 ...	1	...
	Czar	Ditto ...	March 1903 ...	1	...
			September 1903 ...	...	1
			July 1904 ...	1	1
	Oullin's Golden Gage ...	Ditto ...	„ 1904 ...	1	1
	Jefferson	Ditto ...	Ditto ...	1	1

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
	Kirke's	England ...	July 1904 ...	1	1	
	White Magnum Bonum	Ditto ...	Ditto ...	1	1	
	Golden Esperon ...	Ditto ...	Ditto ...	1	1	
	Monarch	Ditto ...	Ditto ...	1	1	
	Early transparent gage...	Ditto ...	September 1903 ...	...	1	
			July 1904 ...	1	...	
	Swan	Ditto ...	July 1904 ...	1	1	
	Cox's Emperor ...	Ditto ...	Ditto ...	1	1	
	Belgian Purple ...	Ditto ...	September 1903 ...	...	1	
			July 1904 ...	1	...	
	Early Rivers ...	Ditto ...	March 1903 ...	1	...	
			September 1903 ...	...	1	
			July 1904 ...	1	...	

Plum—*contd.*	Ditto	Locally grafted	March 1906	1	...	
	Belle de Louvain	England	September 1903	...	1	
			July 1904	1	...	
	Blue Rock	Ditto	September 1903	...	1	
			July 1904	...	1	
	Sultan	Ditto	September 1903	...	1	
			July 1904	...	1	
	Victoria	Ditto	Ditto	...	1	
	Curlew	Ditto	Ditto	...	1	
	Greengage	Ditto	September 1903	...	1	
			July 1904	...	1	
	Reine Claude	Ditto	September 1903	...	1	
			July 1904	...	1	
	Unknown	England	March 1903	1	...	
			July 1904	1		1
	Denniston Superb	Ditto	September 1903	...		1
			Total	20		26

N.B.—*Except* those planted in March 1903, and the locally grafted Early Rivers, the rest were transferred to their present stations from the terraces in the Fruit Garden where they were first planted in March 1903.

STATEMENT I—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
Besides, there was one graft locally made waiting to be transplanted, namely—						
Plum—*concld.* ...	Belgian Purple ...	Locally grafted ...	June 1906 ...	1	...	
	Early Silver ...	England ...	March 1903 ...	2	...	
			September 1903 ...	...	1	
	Ditto	Local grafted ...	1906 ...	1	...	
	Noblesse	England ...	March 1903 ...	1	...	
	Dr. Hogg	Ditto ...	Ditto ...	2	...	
	Ditto	Locally grafted ...	1906 ...	1	...	
Peach ...	Rivers Early York ...	England ...	March 1903 ...	1	...	
			September 1903 ...	...	1	
	Roya George ...	Ditto ...	Ditto ...	...	1	
			Total ...	8	3	

Besides, there were the following grafts locally made waiting to be transplanted :—

Cherry ...	Early Silver ...	Locally grafted ...	March 1906 ...	9	...		
	Dr. Hogg	Ditto ...	Ditto ...	1	...		
	Noblesse	Ditto ...	Ditto ...	9	...		
			Total ...	19	...		
	Flemish Red ...	Eng'and ...	March 1903 ...	1	...	The trees planted in September 1903 and July 1904 were transferred from the terraces in the Fruit Garden, where they had been first planted in March 1903.	
			September 1903 ...	...	1		
			July 1904 ...	1	...		
	Early River's Black ...	Ditto ...	March 1903 ...	1	...		
	May Duke ...	Ditto ...	Ditto ...	1	...		
			July 1904 ...	1	...		
	Royal Duke ...	Ditto ...	March 1903 ...	2	..		
			July 1904 ...	1	...		
	Giant D'Heidel finger ...	Ditto ...	March 1903 ...	1	...		
			July 1904 ...	2	...		
	Kent Bigarreau ...	Ditto ...	March 1903 ...	1	...		
			July 1904 ...	1	...		

STATEMENT I—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
Cherry—*concld.*	Napoleon ...	England	March 1903 ...	1	...	
			July 1904 ...	1	...	
	Black Eagle ...	Ditto	March 1903 ...	1	...	
			July 1904 ...	1	...	
	St. Margarets ...	Ditto	March 1903 ...	1	...	
			July 1904 ...	1	1	
	Emperor Francis ...	Ditto	Ditto ...	1	1	
	Early Elton ...	Ditto	Ditto ...	1	1	
			September 1903 ...	...	1	
	Cleveland Begarreau ...	Ditto	July 1904 ...	1	...	
	Guigne D' Winkler ...	Ditto	Ditto ...	2	...	
	Governor Wood ...	Ditto	Ditto ...	1	1	
			September 1903 ...	...	1	

	Black Tartarian ...	Ditto ...	September 1903 ...	...	1		
			July 1904 ...	1	1		
	Florence	Ditto ...	*September* 1903 ...	...	1		
			July 1904 ...	...	1		
			Total ...	26	11		
Apricot ...	Royal	England ...	June 1903 ...	1	...		
	Oullin's Early Peach ...	Ditto ...	Ditto ...	1	...		
	Blenheim	*Ditto* ...	September 1903 ...	...	1	Transferred from Fruit Garden.	
	Total	.....	.....	2	1		
Almond ...	Amandier Communis ...	England ...	February 1904 ...	3	...		
			March 1904 ...	...	1		
	Thin shell	Ditto ...	February 1904 ...	1	...		
			Total ...	4	1		

STATEMENT I—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at.		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
Walnut ...	Kashmir	Kashmir (grown from seed).	Summer 1905 ...	12	5	
	Besides, there were 26 3-years old trees in the Nursery at the Fruit Garden.					
	Brunswick	Local cuttings ...	1905 ...	5	...	
			June 1906 ...	1	...	
			March 1907 ...	6	...	
	Violette Sepor ...	Ditto ...	June 1906 ...	5	...	
			September 1906 ...	1	...	
			March 1907 ...	2	...	
	Bourjasotte Noire ...	Ditto ...	June 1906 ...	3	...	
			September 1906 ...	1	...	
			March 1907 ...	1	...	
	Bourjasotte Grise ...	Ditto ...	June 1906 ...	1	...	
			September 1906 ...	1	...	
			March 1907 ...	1		

Fig ...	Ronde de Violette Hative	England ...	March 1903 ...	1	...
			1905 ...	3	1
	Figue D'or ...	Local cuttings ...	March 1907 ...	2	...
	St John	England ...	„ 1903 ...	1	...
			September 1906 ...	5	...
		Local cuttings ...	March 1907 ...	1	...
			„ 1905 ...	1	...
	Pingo De Mel ...	Ditto ...	March 1907 ...	1	...
	Black Ischia ...	England ...	„ 1903 ...	1	...
		Local cuttings ...	„ 1907 ...	2	...
			„ 1905 ...	2	...
	White Marseilles ...	Ditto ...	September 1906 ...	1	...
			March 1907 ...	2	...
	Colonel DeSignora ...	England ...	„ 1903 ...	1	...
	Brown Turkey ...	Local cuttings ...	1905 ...	3	2
	Poona	Poona ...	March 1907 ...	4	...
			Total ...	59	3

STATEMENT I —*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
	N. B.—Besides, there were the following numbers of rooted cuttings waiting to be transplanted. The cuttings were made in the autumn of 1906 :—					
Fig—*concld.* ...	Black Ischia ...	.....	.....	3	...	
	Brown Turkey ...	.....	.....	1	...	
			Total ...	4	...	
	English No. 1 ...	Local cutting ...	June 1904 ...	1	1	Nos. 1, 2, 3 and 5 name not known owing to loss of label.
		England ...	March 1907 ...	1*	...	
	„ „ 2 ...	Ditto ...	July 1903 ...	1	...	
		Local cutting ...	June 1904 ...	1	...	
	„ „ 3 ...	England ...	July 1903 ...	1	...	
		Local cutting ...	March 1904 ...	2	2	
	„ „ 4 (Golden Queen).	England ...	July 1903 ...	1	...	
		Local cutting ...	1904	2	2	
		Ditto ...	1905	2	...	

Grape	„ „ 5	Local cutting	1904	2	7	
		England	March 1907	1*	...	
	„ „ 6 (Lady Downe's seedling).	England	July 1903	1	...	
		Local cutting	1904	1	...	
		Ditto	1906	1	...	
		Ditto	1907	2	...	
	Local Black	From a vine in the Roman Catholic Mission Compound.	1904	7	11	
	Merlot	Cuttings obtained from Kashmir in 1903.	1906	3	...	
			1907	15	...	
	Cabernet Sauvignon	Ditto	1906	1	...	
			1907	11	...	
	Malbeck Wine	Ditto	1905	2	...	
			1907	5	...	
	Sanvignon Saulere	Ditto	1906	2	...	
			1907	12	...	

* The two vines marked with asterisks were removed from the plant house, to terraces in the fruit field in March 1907.

STATEMENT I—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
rape—*concld.*	Semiton Santere ...	Cuttings obtained from Kashmir in 1903.	1906 ...	3	...	
			1907 ...	10	...	
	Cabernet	Ditto ...	1906 ...	4	...	
			1907 ...	12	...	
	Hosseini Cabuli ...	Ditto ...	1906 ...	2	...	
	Chasellas	Ditto ...	1907 ...	10	...	
			Total ...	118	23	
	N.B.—Besides, there were the following number of rooted cuttings awaiting removal to permnent sites :—					
	English, No. 1 ...	.....	.....	3	...	

	„ „ 3 ...	.....	.....	11	...
	„ „ 4 (Golden Queen).	.....	.....	32	...
	„ „ 5 ...	.....	.....	32	...
	„ „ 6 Lady (*Downe's* seedling).	.....	.....	2	...
	Black	.....	.....	200	...
	Kashmir	.....	.....	190	...
			Total	470	...
Spanish chestnut.	Spanish Chestnut ...	Legacy from former Model Farm about 30 years old.	...	...	54
	Ditto	Saharanpur ...	June 1903 ...	21	...
			Total	21	54
	N.B.—Besides, there were 260 seedlings grown locally from seed sown in 1906.				
Cherimoyer ...	...	From seed obtained from the Southern Shan States.	1904	5	...
			1906	1	...
		.....	Total	6	...

STATEMENT I—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
Tree Tomato ...	.....	From seed obtained from Ceylon.	1904	3	...	
N.B.—Besides, there were 350 seedlings grown locally from seed.						
Mountain Papaya	.....	From seed obtained from Ceylon.	1904	15	...	
		Ditto ...	1906	8	...	
			Total	23	...	
N.B.—Besides, there were 110 seedlngs grown locally from seed produced at the Fruit Garden.						
Loquat ...	.....	From cuttings taken from trees in the station.	1903	3	...	

Guava ...	Smooth, green ...	Saharanpur ...	1905 ...	1	...		
		Local layerings ...	1907 ...	2	...		
	Cattleya	Saharanpur ...	1905 ...	1	...		
	Guineusis	Ditto ...	1905 ...	1	...		
			Total ...	5	...		
Khasi orange and citron.	.....	Local ...	1904 and 1905 ...	105	...		
Raspberry ...	Superlative ...	Suckers from plants received from England in 1903.	.....	5	...		
	White Antwerp ...	England 1906 ...	March 1907 ...	5	...		
	Bunyard Superlative ...	Ditto ...	Ditto ...	3	...		
			Total ...	13	...		
Besides these were 8 plants in the planthouse waiting to be removed to the field.							
Gooseberry ...	Early Sulphur ...	England ...	September 1903 ...	...	1		
			July 1904 ...	...	1		
	White Smith ...	Ditto ...	September 1903 ...	...	1		

STATEMENT I—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted	Number planted at		Remarks.
				Fruit Garden.	Farm.	
1	2	3	4	5	6	7
Gooseberry—*concld.*	Crown Bob ...	England ...	September 1903 ...	...	1	
			July 1904 ...	1	...	
	Lancashire Lad ...	Ditto ...	Ditto ...	...	1	
	Hedgehog ...	Ditto ...	Ditto ...	...	3	
	Winham's Industry ...	Ditto ...	Ditto ...	...	1	
			Total ...	1	9	
	Baldwin's Black ...	England ...	September 1902 ...	...	3	
			July 1904 ...	4	...	
	Red Dutch ...	Ditto ...	September 1903 ...	1	...	
			July 1904 ...	...	2	

Currant ...	Red Scotch ...	Ditto ...	September 1903 ...	...			2	
			July 1904 ...		4		4	
	Boskop Black ...	Ditto ...	September 1903 ...	...			2	
			July 1904 ...		2		2	
	White Versailles ...	Ditto ...	September 1903 ...	...			2	
		Ditto ...	July 1904 ...		1	...		
		Ditto ...	March 1907 ...		6	...		
		Local cuttings ...	June 1906 ...		5	...		
	White Dutch ...	England ...	September 1903 ...	...			3	
			July 1904 ...		2		1	
	Red Utrecho ...	Ditto ...	September 1903 ...	...			3	
			July 1904 ...		1	...		
			Total		24		25	

STATEMENT II.

Showing the number and description of Fruit Stocks at the Farm and Fruit Garden on 30th June 1907.

	At the Fruit Garden.	At the Farm.	Total.
1	2	3	4
	No.	No.	No.
Soh-shur (wild pear)	1,309	1,263	2,572
Soh-phoh (wild apple)	104	1,270	1,374
Soh-iong (Khasi cherry)	301	...	301
Plum	578	612	1,190
Peach	97	...	97
Fig (wild Khasi)	7	...	7
Manjuren (wild grape)	10	...	10
Total	2,406	3,145	5,551

ANNUAL REPORT ON THE TROPICAL PLANTATION AT WAHJAIN FOR THE YEAR ENDING THE 30TH JUNE 1907.

History and description.

THE tropical plantation was started in January 1904. It is situated on the southern slopes of the Khasi Hills, the home of the Sylhet orange, and occupies the top and slopes of a ridge about 1,200 feet above the sea level. The site of the plantation was selected by me. It is close to the Cherrapunji-Theria bridle path and about seven miles below Cherrapunji.

The plantation was opened under the orders of Sir Bampfylde Fuller with the idea of experimentally introducing certain of the tropical products of Ceylon and Madras, the most important among these being cocoa, the greater and the lesser cardamom, cinnamon, nutmeg, clove, camphor, and lemon grass. I was deputed by Government in the autumn of 1903 to Madras and Ceylon to study the cultivation of these products and to procure seeds and plants. Various tropical fruit trees, new to the Khasi Hills, have been procured for trial and planted at Wahjain. Most of the trees planted were obtained from the Royal Botanical Garden at Peradeniya in Ceylon and from Madras. The plantation also contains a small area planted with coffee, which has been in recent years introduced by private enterprise in the Khasi Hills, and a large number of the more common economic plants of the country, such as orange, different species of citrus, betel-nut, *pan* and black-pepper. These are being cultivated for observation and study.

The plantation has an area of 53·54 acres, out of which 14·50 acres were planted out up to the close of the year under report, and the rest is forest. The cultivated area is divided into six fields, of which the lowermost lies about 600 feet below the top of the ridge. The whole area was under forest at the time of acquisition. The first operation undertaken was to mark out a number of fields, and to remove the forest by felling and burning. In two fields the forest has not been wholly removed; the larger trees have been retained for shade, and the ground underneath cleared of undergrowth. These two fields are intended for the rearing of such plants as cardamoms, which are unable to stand full exposure to the sun.

2. The surface of the land is strewn with boulders, which give it an uninviting appearance. The boulders prevent the soil which lies among them from being washed away by the heavy rain which falls on the southern slopes of the Khasi Hills. The rocky nature of the ground does not permit of plough or spade cultivation.

Soil.

The rocks on the surface are mostly sandstone, but outcrops of limestone are seen at several places. The soil in the greater portion of the plantation is a loose loam, dark on the surface owing to admixture of organic matter, but of a yellowish colour underneath. The soil is mixed with gravel. In places the soil is very sandy and trees planted in it do not thrive well. Among the limestone rocks, the soil is of an adhesive texture and is very different in quality from the soil found on the greater portion of the plantation.

Two samples of soil from the plantation were analysed by Dr. Leather with the following results:—

——	No. 1.	No. 2.
1	2	3
Per 100 *parts of whole soil.*		
Stones	3·62	17·48
Fine earth	96·38	82·52
	100·00	100 00
Per 100 *parts of fine earth.*		
Insoluble silicates and sand ...	72·63	78·43
Ferric oxide	5·43	2·86
Alumina	10·85	11·20
Manganous oxide	0·09	0·03
Lime	1·06	0·15
Magnesia	0·58	0·41
Potash	1·74	1·97
Soda	0·10	...
Phosphoric acid	0·05	0·02
Sulpuric acid	0·06	0·01
Carbonic acid	0·07	0·05
Organic matter and combined water	7·34	4·87
	100·00	100·00

—	No. 1.	No. 2.
	2	3
Nitrogen	0·15	0·05
Available P_2O_5	0·0015	0·0004
„ K_2O	0·009	0·008

Dr. Leather reported as follows on the two samples :—.

"No. 1 contains a fair amount of organic matter and nitrogen, and a large amount of potash (total), but the amounts of carbonate of lime and readily available phosphates and potash are decidedly small. No. 2 is a quite different soil. It is white and contains comparatively little iron, with a high proportion of alumina. Of the chief plant foods it contains only very little, and should respond well to any complete manure."

Sample No. 1 was taken from a spot containing limestone rock, and No. 2 from a spot a few feet away which rested on sandstone. Sample No. 2 represents the main class of soil found on the plantation.

The analyses were made in connection with my contribution to the Pusa Agricultural Journal of January 1906 on the cultivation of orange in the Khasi Hills.

Climate.

3. Wahjain lies at a short distance below the plateau of Cherrapunji, which holds the world's record for rainfall, and which it resembles in respect of the heavy precipitation of rain that occurs during the spring and summer months. During the spring and early summer (March to May), the weather is characterised by high winds and frequent thunderstorms, with heavy bursts of rain, which bring on a quick growth of vegetation. The monsoon follows with an amount of rainfall not far removed from that of Cherrapunji itself, and is succeeded about the middle or end of October by calm and particularly rainless weather, which prevails through the winter up to about the middle of March.

There is far too much rain during eight months of the year and practically none for a continuous period of four months. Herein the climate of Wahjain differs from that of Ceylon and other tropical countries where such long periods of drought

are unknown. The absence of rain has been found particularly trying to such essentially tropical plants as the nutmeg and the clove. It is also very possible that the winter temperatures of Wahjain are too low to suit such plants. The lowest temperature in the shade in 1905 was 43°F. in February and the highest 90°F. in May.

Character of the season.

4. The rainfall received on the plantation from July 1906 to June 1907 was as follows :—

Month.	Rainfall.	No. of rainy days.
1	2	3
	Inches.	
1906 July	110·47	30
„ August	102·90	27
„ September	28·58	19
„ October	16·26	5
„ November	4·17	3
„ December	Nil	Nil
1907 January	1·20	3
„ February	1·16	3
„ March	8·43	11
„ April	19·30	19
„ May	11·09	15
„ June	64·21	24
Total for the year ...	367·77	159

Rainfall has been recorded at Wahjain since September 1904. The normal rainfall of the place cannot be ascertained until the record has extended over several years. There was nothing very abnormal about the character of the season under report.

Work done during the year.

5. As mentioned before, the method of cultivation pursued on the plantation is of a simple nature. It consists in clearing the land of jungle growth and loosening the soil round the plants from time to time. Liquid manure prepared from raw cowdung and water was applied every week through the greater part of the year to all the more important plants.

The coffee, lemon-grass and pine-apple plantations were extended during the year, and vacancies among the older

coffee and pine-apple plants were supplied. The Seville and Jamica orange trees were removed from the nursery and transplanted on permanent sites in June last.

The only new plants introduced during the year were a variety of Japanese orange and several species of Japanese citrus which were kindly supplied by the Commercial Attache' of His Majesty's Embassy at Yokohama.

Trial distillations of lemon-grass oil were made from time to time during the year.

A history of plants was prepared during the year by the Superintendent of the Experimental Farms. This history has been based on the detailed lists of plants which were prepared and revised from time to time by me and will be maintained as a continuous record of the progress and treatment of each plant under trial at Wahjain.

Survey of the plantation.

6. A boundary and detail survey of the plantation was carried out during the previous year by Babu Srish Kumar Sen, Sub-Deputy Collector. The boundaries were temporarily demarcated by him with pegs placed inside roughly-constructed mounds of stones. These were replaced during the year by slabs of stone with the letters T. P. B. inscribed on them.

7. The houses on the farm are of a more or less temporary nature. All of them were badly damaged during the year by high winds and had to be repaired. The total cost of repairs amounted to Rs. 130-10-10. The plant house which was erected in 1904 and was used as a covered nursery for the propagation of plants was so badly damaged that it was thought desirable to dismantle it altogether.

Plants under trial.

8. The list annexed hereto shows the various species of plants under trial, the sources from which they were obtained, their age and the progress which each species has made. In the case of the few plants which have began to yield, the results obtained have been noted in the column of remarks.

The most important plants, namely, those for the sake of which the Tropical Plantation was created, are cocoa, lesser cardamom, cinnamon, nutmeg, clove, citronella and camphor. There is no citronella at Wahjain, none of the plants received from Ceylon having reached the plantation alive. Lemon-grass is a far more valuable plant and is being cultivated in

its place. Among these plants, the lesser cardamom, cinnamon, camphor and lemon-grass have exhibited excellent growth. Some of the lesser cardamom clumps are in bearing now, though they have not yet reached full growth. They are expected to give full yields a year or two hence. The cinnamon plants appear very healthy; some of them have grown quite five feet high and are now producing new shoots. The plants are now only two years old, and it will be another two or three years before they will begin to yield. The camphor trees are growing well, but they are not yet large enough to admit of pruning. It is proposed to try the method of distilling camphor from twigs on the system which has been experimentally introduced in Ceylon. The method of manufacture pursued in Formosa and Japan in which the entire tree is cut down and the wood is chopped up and distilled is clearly out of the question with us. It is only possible where the trees occur naturally in forests as they do in the countries mentioned.

The lemon-grass plantation was extended by nearly 1⅔ acres during the latter part of the year. The total area under the grass now is 4·64 acres. As shown in the list annexed, lemon-grass was obtained from four distinct sources, *viz.*, Ceylon, Tyrna, Moriani and Cochin in Madras. It is not known for certain what species of grass each of these belongs to. The grass from Cochin has been flowering at Wahjain. A specimen of the plant has been identified by Captain Gage, Superintendent of the Royal Botanical Gardens, Sibpur, as *Andropogon nardus, L.* The other three grasses have never flowered. From a perusal of a monograph on "The Oil-grasses of India and Ceylon" by Dr. Otto Stapf published in the Kew Bulletin of Miscellaneous Information (No. 8 of 1906), it seems to me that all these three grasses which look exactly alike belong to one and the same species—the one described by him under the name of *Cymbopogon citratus.* This species which includes the cultivated lemon-grass of Ceylon as well as the scented grass grown as a garden plant in Bengal and Madras is distinguished from similar species of grass by its habit of flowering at rare intervals. I have accordingly given the name of *Cymbopogon citratus, Stapf,* to the three grasses obtained from Ceylon, Tyrna and Moriani. Dr. Stapf has assigned the Malabar lemon-grass to the species *Cymbopogon flexuosus,* Stapf, which is the same as the species described by Hooker in his Flora of British India under *Andropogon nardus,* var. *flexuosus.* For the

sake of uniformity I have taken Dr. Stapf's name in preference to the name given by Captain Gage, which appears to be an oder synonym for the same plant.

Trial distillations of lemon-grass were made several times during the year. The yield of oil varied from 3 to 5 ounces by liquid measure per maund of grass. At the earlier distillations, the oil was not accurately measured, but later trials leave no doubt that 3 to $3\frac{1}{2}$ ounces of oil by liquid measure or $2\frac{1}{2}$ to 3 ounces by weight of oil can be safely counted upon from every maund or $82\frac{2}{7}$ pounds of grass. These yields are equivalent to ·19 to ·23 per cent. on the weight of grass. In Ceylon according to a recent circular of the Royal Botanic Gardens (Vol. III, No. 19), the average yield of oil amounts to ·2 per cent. So we can be almost certain that the grass at Wahjain is not poorer in oil than in Ceylon. How the oil will compare with Ceylon and Malabar oil in quality is not yet known.

Mention was made in my last annual report that a sample of lemon-grass oil from the Tropical Plantation was valued by the Cochin Chamber of Commerce at Rs. 100 to Rs. 115 per case of 264 ounces, which is equivalent to about 6 annas per ounce. Samples have since been sent through the Director General of Commercial Intelligence to the London market for valuation. A sample was sent also to the proprietor of a Soap Factory who thought the oil better and purer than the oil which he obtains from Calcutta for perfuming his soaps. He has offered to purchase all the lemon-grass oil we can produce, but I do not wish to enter into any bargain with him until the London valuation is received.

I hope to be able to furnish complete data with regard to the cost of cultivation and manufacture and yield and price of oil in my next annual report.

Nutmeg and clove seem hopeless. The prospects of cocoa also are doubtful. The trees are growing slowly and seem apparently healthy. Some cocoa plants died during the year for no apparent cause other than the unsuitability of the climate.

Among the plants subsequently introduced into the scheme of the plantation, the graetr cardamom, Natal orange, coffee, Ceylon and Kew pine-apples, Sapota and the grafted litchi and mango trees seem very hopeful.

Plant diseases.

9. The only serious plant disease noticed in the plantation is an obscuse fungus disease which has appeared in the greater cardamom plants and already killed a few clumbs. The plants had been growing with great luxuriance, but since the disease appeared they have made little growth. Specimens of the diseased plants have been submitted to the Imperial Mycologist for examination.

I may suitably mention here the appearance of a serious blight that has appeared within recent years among trees on the southern slopes of the Khasi Hills, though so far it has not yet made its appearance at the Tropical Plantation. Dr. Butler was requested to investigate the blight, but not being able to come himself, he deputed his assistant, Mr. S. K. Basu, to examine it. Mr. Basu came in April last and I accompanied him on a visit to several orange gardens in the neighbourhood of our plantation. The disease appeared on examination to be the work of a fungus which enters the tree through the roots and gradually spreads upward to the stem. Mr. S. K. Basu's report on the blight has not yet been received. It seems the fungus may be kept in check by cutting deep trenches between diseased and healthy trees so as to cut off the spread of the fungus underground. Another possible remedy would seem to consist in grafting orange on hardier species of citrus of which the roots may prove on trial to be immune to the attack of the fungus. To test the latter remedy, a small diseased orange garden has been recently lent to us by a Khasia cultivator; the diseased trees have been cut down, leaving the roots in the ground. Several species of citrus have been planted among these roots. It will be seen a few months hence whether any of these citrus trees are attacked by the fungus. As far as my enquiries go, the disease has not yet touched any other species of citrus except the orange.

Receipts and expenditure.

10. The receipts of the plantation during the year amounted to Rs. 16-3-6 and the expenditure to Rs. 1,584-11-7.

The corresponding figures for the preceding year were Rs. 33-5-3 and Rs. 1,662-10-3.

Inspection.

11. The plantation was inspected by the Director of Agriculture once during the year. Owing to my absence on privilege leave and

my subsequent deputation to Calcutta for organizing the Eastern Bengal and Assam Court of the Industrial Exhibition, I was not able to inspect the plantation more than once during the year.

B. C. BASU,

Assistant Director of Agriculture,
Eastern Bengal and Assam.

Shillong,
The 27th July 1907.

List of plants at the Tropical Plantation, July 1907.

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
1	Cocoa (*Theobroma cacao*)				
	"Amelando" ...	Grown from Ceylon seed.	August 1904.	4	The 3-year old plants have grown tolerably well. Out of 20 trees planted in August 1904 only 12 now remain. The tallest of these is about 4 feet high. The cocoa trees are growing too slowly to promise success.
	"Caracas" ...			4	
	"Forestero" ...			4	
	"Cundeamar" ...	Ditto ...	Rains 1905	16	
			Total ...	28	
2	Lesser Cardamom (*Elettaria cardamomum*).				
	"Palni" ...	Palni Hills ...	June 1904	5	The plants are growing well. They have formed large clumps. The tallest clump is 16 feet high. Nine clumps are now in bearing. Out of fifty-three clumps planted in June 1906, only 18 have survived.
		Grown from seed procured from the Palni Hills in Madras.	April 1905	40	
		Ditto ...	June 1906	18	
3	"Mysore" ...	Plants obtained from Ceylon.	Ditto ...	3	
			Total ...	63	clumps.
4	Greater cardamom (*Amomum Subulatum*).	Plants obtained from the Lloyd Botanical Garden, Darjeeling.	June 1904	28	Many clumps were attacked and killed during the year by a fungus disease which has not yet been identified. Four are now in bearing. The plants do not look promising.
		Ditto ...	June 1906	58	Plants obtained by breaking up old clumps of June 1904 in Field C, where they were not growing well owing to sandy soil and want of shade. These plants have so far escaped disease.
			Total ...	79	clumps.

List of plants at the Tropical Plantation, July 1907—contd.

Serial No. of species.	Name of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth.
1	2	3	4	5	6
	Nutmeg (*Myristica fragrans*).	From Ceylon seed	April 1905	33	Only 33 have survived out of 80 seedlings planted in 1905. The plants are still very small, though apparently healthy. The best of them are 15 to 18 inches high. The plants are growing so slowly that I do not expect they will succeed.
5	Clove (*Eugenia caryophyllata*).	Ditto ...	Ditto ...	5	Only 5 have survived out of 43 planted in 1905. The plants are very small, none being more than 16 inches high. Clove seems to be extremely susceptible to drought, and it has been necessary to protect the plants during the dry season from the sun by covering them with grass roofs and watering them daily. Altogether clove seems very unpromising.
6	Cinnamon (*Cinnamomum zeylanicum*).	Ditto	Ditto ...	22	The 22 clumps contain 43 plants. They have made good growth. Plants are stooling now. Tallest 5 feet 6 inches high. Promising.
7	Camphor (*Cinnamomum camphorum*).	Plants from Ceylon.	July 1904	9	Growing beautifully. The trees are bushy and displaying an exuberant growth.
8	Coffee (*Coffea arabica*).	Locally procured	May 1904	29	Growing very well. Most of the trees are now in bearing and a fair yield of berries is expected.
		Ditto ...	April 1905	870	Growing well.
		Ditto ...	June 1906		
				899	
9	Orange (*Citrus Aurantium*).				
	"Victoria Mamoth" or "Natal."	Natal ...	April and June 1904	9	Growing remarkably well. One tree flowered last spring and is bearing a single fruit now. Some of the trees were infested with a scale insect and treated with resin-soda wash.
	"Seville" or "Bitter" orange.	From Ceylon seed	June 1907	1	
	"Jamaica" ...	From Jamaica seed.	Ditto ...	14	
	"Malta" ...	Lahore ...	April 1906	4	Growing well.
	"Japanese Summer."	Japan ...	June 1907	2	
	"Khasia" ...	Local ...	June 1904	50	Growing very well.
		Do. ...	June 1906	381	Growing well.
			Total ...	461	

List of plants at the Tropical Plantation, July 1907—contd.

Serial No. of species.	Name of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
10	Citrus of different species.				
	"Malta" Citron	Cuttings from a tree in the abandoned Government citrus plantation at Theriaghat.	Summer 1905.	4	Growing well.
	"Soh-mad" (citron).	,, ...	,,	24	Making fair growth.
	"Soh-myndong"	,, ...	,,	22	
	"Soh-kwit" ...	,, ...	,,	20	
	"Soh-nyngor"... (*pummelo*).	,, ...	,,	17	
	"Soh-niamring"	,, ...	,,	24	
	"Soh-pai" ...	,, ...	,,	26	
	"Soh-khyllah"...	,, ...	,,	9	
	"Soh-thiang" ...	,, ...	,,	8	
	C. decumara ...	Japan ...	June 1907	2	
	C. Medica chirocarpa.	,, ...	,,	1	
	C. Nobilis Satsuma	,, ...	,,	2	
	C. Nobilis Kinakuni.	,, ...	,,	2	
	C. Nobilis Umshim	,, ...	,,	1	
	C. Kinkan (round fruit).	,, ...	,,	2	
			Total ...	164	
11	Litchi (grafted) (*Nephelium Litchi.*)	Calcutta ...	June 1904	2	Growing very well. One tree has been flowering for two years, but set no fruit.
12	Mango (grafted) (*Mangifera Indica*).				
	"Fasli" ...	Ditto ...	Ditto ...	2	All growing well.
	"Langra" ...	Ditto ...	Ditto ...	2	
	"Bombay" ...	Ditto ...	Ditto ...	2	
	Total ...	.....	.....	6	

List of plants at the Tropical Plantation, July 1907—contd.

Serial No. of species.	Name of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
13	Sapota (*Achras sapota*).	Calcutta ...	June 19 4	2	Growing very well. Both flowered again this year, but set no fruit.
14	Papaya (*Carica papaya*).				
	"Bangalore" ...	From g rden seed	March 1906	2	A superior variety. All the trees of 1904 have died out. The plant seems unable to withstand heavy rain. One tree since dead gave a few fruits which were of very good quality.
15	Pine-apple (*Ananas sativas*). "Ceylon."	Dibrugarh Jail and suckers from original plants.	Rains 1904 and 1906.	433	All growing well. The plants of 1904 have been bearing since 1906. This pine-apple is of larger size than the country fruit; the eyes are shallow, flesh white, very succulent and of nice flavour, though slightly more sour than the indigenous kind. The leaves differ from those of country variety in having smooth edges. The variety is expected to be popular.
	"Kew" ...	Ceylon ...	Ditto ...	12	Growing well. The older plants are now in bearing. The quality of the fruit remains to be seen.
	Total ...	.....	.....	445	
16	Plantain (*Musa sapientum*).				
	Strawberry-flavoured "Bombay."	Empress Botanical Gardens, Poona.	May 1906	15	Growing slowly. The soil is too poor for planting unless it is planted directly after burning the forest.
					N.B.—Besides these, the plantation contains a large number of Khasi and Assam Valley plantain of several varieties, grown chiefly for the sake of shade. The clumps have become old and are dwindling.
17	Bread fruit (*Artocarpus incisa*).	Ceylon ...	July 1904	2	Growing slowly. The plants suffered from the frosts of 1905, otherwise they would have grown to a greater height. At present, they are about 2' 6" high and look healthy. They were covered with thatch in the dry season as protection against sun.
18	Mangosteen (*Garcinia Mangostana*).	Ditto ...	April 1903	6	The plants exhibit very little growth and are most unpromising.
19	Nam-nam (*Cynometra coulifiora*).	Ditto ...	July 1904	2	These plants were received from Peradeniya for trial. It is not known what the fruits would be like, except in case of Cochin Goraka, which is wild in the Assam forests and known as tepor tenga in Assam Valley and dia-phal in Sylhet. Ketembella and Sandoricum are growing well. Nam-nam and Cochin Goraka show very poor growth.
20	Sandoricum (*Sandoricum sp*).	Ditto ...	Ditto ...	1	
21	Ketembella (*Aberia gardeneri*).	Ditto ...	Ditto ...	3	
22	Cochin-Goraka (*Garcinia Xanthochymus*).	Ditto ...	Ditto ...	2	

List of plants at the Tropical Plantation, July 1907—contd.

Serial No. of species.	Name of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
23	Rambutan (*Nephelium lappaceum*).	Plants from Ceylon	July 1904	2	The plants are growing slowly. The tallest is 5' high.
		Raised from Ceylon seed.	April 1905	6	
	Total ...	.....	.....	8	
24	Soursop (*Anona muricata*).	Plants from Ceylon	July 1904	7	Growing fairly well. Tallest plant is 4' 9" high.
		Raised from Ceylon seed.	April 1905	16	
	Total ...	.....	.....	23	
25	Betel-nut (*Areca Catechu*).	Local ...	1903 ...	190	This number has survived out of some five hundred planted in 1903 along the boundaries of fields A, B, C, and E. They are growing very slowly.
26	Betel-leaf (*Piper betel*).	Ditto ...	August 1904	3	These have survived out of 80 plants planted in 1904 and 100 in 1905. Growing well. Being grown for observation and study.
			June 1905	32	
	Total ...	.....	.....	35	
27	Black pepper (*Piper nigrum*).	Local ...	August 1904	5	These have survived out of 80 plants planted in 1904 and 100 in 1905. Growing well. Being grown for observation and study.
			June 1905	11	
	Total ...	.....	.....	16	
28	Lemon-grass (*Cymbopogon citratus*).	From three distinct sources, viz:— (1) Ceylon under name of lemon-grass in April 1905. (2) Tyrna in August 1904; name not known. (3) Moriani, Assam Valley, in December 1904, *name not known.*	See column 3.	4·6 acres.	See report, paragraph 8.
	Lemon-grass (*C. flexuosus*).	Cochin under name of lemon-grass in June 1906.			

List of plants at the Tropical Plantation, July 1907—concld.

Serial No. of species.	Name of species and variety.	Whence obtained	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
29	Rusa grass (*C. Martini*).	From seed obtained from Central India (through Reporter on Economic Products).	June 1905	Clumps. 80	This plant yields the *rusa, or palmarosa* oil of commerce. The plants look unhealthy and are not likely to succeed.
	Grand total (excluding lemon-grass).	.....	.....	2,604	

Annual Report of the Upper Shillong Agricultural Station for the year ending the 30th June 1907.

Introductory.

Since 1903, the Farm has been managed as a joint concern with the Fruit Garden. Much of the work has been common to the two Institutions. The mainwork on the Fruit Garden has been the cultivation of fruit trees imported from the temperate climates of Europe, but part of this work is carried on at the Farm, where many of the fruit trees were transferred in 1903 and 1904 with a view to test the effect of a higher elevation on their growth. On the other hand, the cultivation of potatoes which has been one of the chief items of work on the programme of the Farm has to be carried on partly at the Fruit Garden for want of suitable land at the Farm. Although managed as a joint concern, the accounts of the two stations are kept separate.

History and description of the Farm.

2. The Upper Shillong Farm was established in the year 1897-98. It is situated on the Cherrapunji road, 5½ miles from the station of Shillong, and occupies the site of the old Model Farm which ceased to exist in 1879. The elevation of the Farm is 5,900 feet, *i.e.*, about 900 feet higher than the Shillong town. The boundaries of the Farm have not been surveyed. A large area of pine forest was annexed to the Farm in 1905. The cultivated area of the Farm is divided into a number of separate fields having an aggregate area of about nine acres. All the fields but one lie on the slopes of a long and narrow valley, the bottom of which consists for the most part of marshy land, covered with a thick growth of wild grass. The forest is of use to the Farm as a source of timber and small wood, a large quantity of which is annually required for fencing and building purposes.

The soil over most part of the Farm is a coarse reddish loam of a very loose texture which enables it to be worked with the greatest ease. The sub-soil is of a more pronounced reddish colour and of great depth. In a small portion of the Farm the soil is of black colour, due, it is believed, to the existence of some mineral compound. The soils have not been analysed. In point of quality, it is extremely poor, and very little can be grown on it without the help of manure. The soil at the bottom of the valley is very different from the above. It is a dark-coloured clay or clayey loam, extremely rich in organic matter, having been under

a thick growth of grass for many years. The upper part of the soil is a matted mass of half decayed grass roots. The valley has not yet been properly drained. Some work in this direction was done during the year under report, but as yet the land at the bottom of the valley is not in a fit condition for cultivation and is useful only as pasture ground for the cattle of the Farm. A small portion of the drained area has been newly reclaimed and placed under cultivation.

Besides the natural poverty of the soil, the greater portion of the Farm suffers from the disadvantages of an exposed situation. It is colder and more windy than Shillong. frosts are of very common occurrence during the winter, and more severe than in the town. During winter the growth of vegetation is wholly suspended.

Among the main objects with which the Farm was established, were the introduction of superior varieties of potato which is the most important staple grown on the higher plateau of the Khasi Hills, the cultivation of fodder crops and the preservation of fodder in silos for use in the winter when natural fodder becomes extremely scarce, and the encouragement of fruit cultivation. These objects are still held in view. New items of work have been added from time to time to the programme of the Farm. Among these the most important has been the breeding of improved strains of cattle and pigs with a view to their introduction in the district.

Meteorology of the year.

3. The year under report covers the latter part of the monsoon of 1906, the winter of 1906-1907 and the spring and early monsoon of 1907. It thus includes part of two growing seasons. There was nothing unusual about the meteorology of the first season. The current season of which the first part is included in the period under report has been very favourable to the crops.

Work done during the year.

4. The work done during the year at the Farm falls under the following heads :—

I. Experiments with potato.
II. Preservation of fodder and silos.
III. Breeding of cattle.
IV. Breeding of pigs.
V. Cultivation of fruit trees.
VI. Introduction of improved agricultural practices in the district.
VII. Miscesellaneous.

The cultivation of fruit trees is dealt with in the annual report of the Fruit Garden to which this item of work properly belongs.

The work under the remaining heads is described below.

Experiments with potatoes.

5. The experiments were—

(1) to test varieties ;
(2) to test the effect of spraying with Bordeaux mixture as a preventive of disease ;
(3) to compare seed obtained from the summer crop of potatoes with seed obtained from the winter crop, and
(4) to test the value of rape-cake as a manure for potatoes.

The first three experiments were made at the Fruit Garden and the last at the Farm.

Varieties of potatoes tried.

6. Twenty-five varieties were under trial. They were the same as grown in the previous year. Of these, ten had been cultivated for several years at the Farm, and the fifteen others were imported from England in 1905 and grown for the first time in the summer of 1906. A second crop of all the varieties was raised in the autumn of 1906 solely for the sake of seed. This seed was used in every case in the variety trials of 1907. Some of the varieties gave very small yields in the second crop of 1906, so that the area which could be planted with these in 1907 was exceedingly small. The experimental area was divided into small beds, each 1-320th of an acre. Some varieties occupied four of these each, others two each, while the rest were grown each on a single bed. The land was uniform throughout to all appearance and received the same treatment for several years past as well as during the year under report. The crop was planted on the 21st and 22nd February and harvested between the 2nd and 14th July. The manures used were 800 baskets of cowdung and 20 maunds of rape-cake per acre. The crop was sprayed with Bordeaux mixture twice during the season.

The yields obtained are shewn in the following table. It will be seen that only four varieties which did best in 1906 and produced a sufficiently large quantity of tubers for saving in 1907 could be grown in duplicate plots. These are *Magnum Bonum, King Edward VII, King of Potatoes* and *Northern Star*. The last three varieties have become famous in England in recent years, and *Magnum Bonum* is an old established variety which still holds its ground there. The

first three of these varieties came out the best in our trials *Eldorado* too, another famous variety of recent creation, has done well, though it did very badly in 1906 and only a very small quantity of seed tubers was available for sowing in 1907.

Table showing the yields of varieties of potato grown in 1907 ; (*summer crop*).

Name of variety.	Number of beds planted (each bed 1—320 acre).	Quantity of seed sown.	Yield.	Yield per acre.	Number of times seeds was reproduced in yield.
1	2	3	4	5	6
		Seers.	Mds. srs.	Mds.	
1. Magnum Bonum	4	10	3 34	308	15·4
2. Northern Star	4	10	2 28	216	10·8
3. King Edward VII	4	10	3 12	264	13·2
4. King of Potatoes	4	10	3 14	268	13·4
5. Nilgiri	4	6	2 7	174	14·5
6. Earliest of all	4	10	2 0	160	8
7. Express	4	10	2 6	172	8·6
8. Good Hope	4	10	2 16	190	9·5
9. Sir John Llewellyn	2	5	1 1	164	8·2
10 Sutton's Magnum Bonum	2	5	1 4	176	8·8
11. Lord of Isles	1	2·5	0 21	168	8·4
12. Patna	1	·5	0 13	104	5·2
13. Aderondack	2		0 29	116	5·8
14. Sutton's Discovery	1	2·5	0 16	128	6·4
15. Early Ruby	1	1	0 22	176	22
16. Early Rose	1	2·5	0 18	144	7·2
17. Brownel's Beauty	1	2·5	0 17	136	6·8
18. Flower Ball	1	2·5	0 16	128	6·4
19. Rent Payer	1	2	0 13	104	6·5
20. Nun Nicer	1	2·5	0 15	120	6
21. Victorious	1	2	0 19	152	9·5
22. Up-to-date	1	2	0 13	104	6·5
23. Noroton Beauty	1	2·5	0 23	184	9·2
24. Sirdar	1	1	0 5	40	5
25. Eldorado	1	2·5	0 32	256	12·8
Duplicate. 1. Magnum Bonum	4	10	2 27	214	10·7
Duplicate. 2. Northern Star	4	8	1 25	130	6·1
Duplicate. 3. King Edward VII	4	10	2 32	224	11·2
Duplicate. 4. King of Potatoes	4	10	2 21	202	10·1

I am reluctant to draw any definite conclusions as to the relative merits of the numerous varieties that were tried, as the area cultivated with each was so small, and there was not seed enough to duplicate the experiment for all the varieties under trial. But the results such as they are leave no doubt that the varieties numbered 2 and 5 to 24 have little chance of equalling Magnum Bonum in respect of yield. The only three varieties which seem capable of competing with Magnum Bonum are King Edward VII, King of Potatoes, and Eldorado. King Edward VII was slightly ahead of Magnum Bonum in the duplicatetrial, but fell behind it in the first one. It is a noteworthy fact that among the very large number of varieties that have been tried at the farm during the last ten years, we have not yet found one which has been able to beat Magnum Bonum. This variety was originally obtained from Nainital where it had been introduced from England. Its cultivation, thanks to the efforts of this department, has spread largely in the Khasi Hills and almost superseded the cultivation of the old variety introduced into these hills by Mr. David Scott some eighty years ago. I do not think any good will be done by continuing the experimental cultivation of most of the varieties grown in 1907.

Spraying with Bordeaux mixture.

7. The spraying experiments were conducted on the lines laid down by Dr. Butler in 1905. They were made for the third time during the year under report. There were two distinct experiments with Bordeaux mixture. The first of these is described in this paragraph. The experiment was made in four series, each consisting of four beds of I—160th of an acre each. In each series one of the four beds was sprayed three times with plain Bordeaux mixture, the second with Bordeaux mixture to which a small quantity of rosin and soda solution was added to make it adhesive, the third with Bordeaux mixture to which *gur* was added with the same object, and the fourth was left unsprayed. The quantity of mixture applied to the sprayed plots was 300 gallons per acre, *viz.*, 60 gallons at the first appliation and 120 gallons at each of the second and third sprayings.

The composition and cost of each description of mixture are noted below :—

Plain Bordeaux Mixture : 300 *gallons.*

	Rs.	a.	p.
Sulphate of copper 18¾ seers at Re. 1 ...	18	12	0
Lime ¾ths of above = 14 seers 1 chattak at 1 anna per seer	0	14	0
Water 300 gallons		...	
Total ...	19	10	0
Labour for preparing mixture and spraying (wages of 6 men at 6 annas)	2	4	0
Total ...	21	14	0

Bordeaux Mixture with Rosin and Soda : 300 *gallons.*

	Rs.	a.	p.
Plain Bordeaux Mixture, 300 gallons...	19	10	0
One hundred pints of rosin-soda solution, containing rosin 6¼ seers at Re. 1 ...	6	4	0
Soda 3⅛ seers at 8 annas ...	1	9	0
Total ...	27	7	0
Labour for preparation and application (wages of 7 men at 6 annas) ...	2	10	0
Total ...	30	1	0

Bordeaux Mixture with gur : 300 *gallons.*

	Rs.	a.	p.
Plain Bordeaux mixture, 300 gallons ...	19	10	0
Gur (same quantity as lime, *viz.*, 14 seers 1 chattak at 4 annas per seer)	3	8	3
Total ...	23	2	3
Labour for preparation and application (wages of 6 men at 6 annas) ...	2	4	0
Total ...	25	6	3

N.B.—The rosin and soda solution is prepared by boiling 1 seer of rosin and ½ seer of washing soda in a gallon or 5 seers of water, till dissolved, adding water during boiling and at the end to keep up the full gallon. One pint or 10 chattaks of the solution is added to every 3 gallons of the Bordeaux mixture.

The yields of potatoes are shown below :—

Treatment.	Yield of area planted (1—160 acre).	Yield per acre.	Variety of potato planted.
1	2	3	4
	Mds. srs.	Mds.	
First series.			
Plain Bordeaux mixture	1 27	268	Magnum Bonum.
Bordeaux mixture with rosin-soda ...	1 15	220	
Bordeaux mixture with gur ...	1 22	248	
Unsprayed	1 3	172	
Second series.			
Plain Bordeaux mixture	1 24	256	Ditto.
Bordeaux mixture with rosin-soda ...	1 13	212	
Bordeaux mixture with gur ...	1 13	212	
Unsprayed	1 6	184	
Third series.			
Plain Bordeaux mixture	1 5	180	King Edward VII.
Bordeaux mixture with rosin-soda ...	1 5	180	
Bordeaux mixture with gur ...	1 0	160	
Unsprayed	1 1	164	
Fourth series.			
Plain Bordeaux mixture	1 25	260	King of potatoes.
Bordeaux mixture with rosin-soda ...	1 20	240	
Bordeaux mixture with gur ...	1 25	260	
Unsprayed	1 16	224	
Average of four series.			
Plain Bordeaux mixture	1 20¼	241	
Bordeaux mixture with rosin-soda ...	1 13¼	213	
Bordeaux mixture with gur ...	1 15	220	
Unsprayed	1 6½	186	

The use of plain Bordeaux mixture was in every series attended with a substantial increase of outturn, as it has always been the case every year since 1900 when spraying experiments were first initiated at the farm; on the other hand, the addition of rosin-soda or gur has failed to show any advantage over the use of the plain mixture; in fact the adhesive mixtures gave less outturns than the latter in every series. In the experiments of 1906, the addition of rosin-soda appeared to have produced a somewhat larger outturn than when plain Bordeaux mixture was used. In this respect the results of the two years are at variance. The usefulness of any adhesive substance added to the spraying material depends no doubt upon the conditions of the weather immediately following the spraying. Thus if spraying is immediately followed by a shower of rain, it is probable that the greater part of the plain mixture would be washed off the leaves and less of the mixture containing an adhesive substance like rosin or gur. On the other hand, if fine weather continues after spraying, there would be no loss of either and both would be equally effective. It is not, however, clear why the plain mixture should produce a larger yield than the adhesive mixtures except on the assumption that the latter has an injurious influence on the leaves.

The net economic results of the experiment are shown below. They are based on the average yields of the four series—

Treatment.	Average yield per acre.	Excess of yield due to spraying.	Value of excess yield at Rs. 2 per maund.	Cost of spraying per acre.	Profits due to spraying per acre.
1	2	3	4	5	6
	Mds.	Mds.	Rs.	Rs. a. p.	Rs. a. p.
Plain Bordeaux mixture	241	55	110	21 14 0	88 2 0
Bordeaux mixture+rosin-soda	213	27	54	30 1 0	23 15 0
Bordeaux mixture+gur	220	34	68	25 6 3	42 9 9
Unsprayed	186	...	...	...	...

During the past season, the potato disease was much less in evidence in the Khasi Hills than in former years; yet

there was a substantial gain from the use of Bordeaux mixture as a remedy for the disease. The sprayed plots continued to grow for a fortnight or three weeks longer than the unsprayed ones and naturally gave larger yields.

The experiments of the past season taken together with those of previous years conclusively show that the use of Bordeaux mixture results in abating the virulence of the potato disease, and in increasing the yield of the crop at the same time. The latter result is only a necessary corollary of the former. These results gain ample confirmation from the experience of Western countries.

8. The second spraying experiment was designed to compare the effects of spraying the potato crop thrice as against twice, once and no spraying. The experiment was made in three series each of which contained four beds. Each bed was 1 —160th of an acre. One of the four beds was sprayed three times, *viz.*, on 14th April while the plants were quite small at 60 gallons per acre, a second time on 9th May at 120 gallons per acre and a third time again at 120 gallons per acre on 2nd June. The second bed received two sprayings on 14th April and 9th May at 60 and 120 gallons per acre, respectively. The third received only one spraying, the one on 9th May at 120 gallons per acre; and the fourth received none. The yields of each series and the average yields of the three are shown below—

Treatment.	Yield of area planted (1-160th acre).	Yield per acre.
	Mds. srs.	Mds.
First series.		
Sprayed thrice	2 4	336
„ twice	1 30	280
„ once	1 24	256
Unsprayed	1 15	180
Second series.		
Sprayed thrice	2 6	344
„ twice	1 30	280
„ once	2 20	240
Unsprayed	1 9	196
Third series.		
Sprayed thrice	1 37	308
„ twice	1 33	292
„ once	1 31	280
Unsprayed	1 25	260

Treatment.	Yield of area planted (1-160th acre).	Yield per acre.
Average of three series.		
	Mds. srs.	Mds.
Sprayed thrice ...	... 2 $2\frac{1}{3}$	329
,, twice ...	... 1 31	284
,, once ...	... 1 $24\frac{2}{3}$	259
Unsprayed ...	... 1 $16\frac{1}{3}$	225

The results quoted above furnish additional proof of the usefulness of Bordeaux mixture, and at the same time they show that the yield is substantially increased by every additional spraying that is given. Thus three sprayings gave larger yields than two, two than one, and even a single spraying while the crop was still young was followed by a considerable increase of yield. The economic results of the experiment are given below :—

Treatment.	Average yield per acre.	Excess of yield due to spraying.	Value of excess yield at Rs. 2 per acre.	Cost of spraying.	Profit due to spraying.
1	2	3	4	5	6
	Mds.	Mds.	Rs.	Rs. a. p.	Rs. a. p.
Spraying thrice (300 gallons) ...	329	104	208	21 14 0	178 2 0
,, twice (180 gallons) ...	284	59	118	13 2 0	104 14 0
,, once (120 gallons) ...	259	34	68	8 12 0	59 4 0
Unsprayed	225	...	...	...	...

The economic results were most remarkable, the expenditure on spraying having been returned 7 to 8 fold in the increased yield which resulted from it.

Summer *versus* winter seed potatoes.

9. Two crops of potato are grown annually in the Khasi Hills. The first or summer crop is planted in February—March and harvested in June-July. It is the main potato

crop of the district. Seed tubers from the summer crop are used for the second or winter crop. It is planted in July-September and gathered in November-January. It is usually sown on the same land as the summer crop, and receives no manure. The crop is cut down by frost before it has had time to mature. The yield is usually very much less than that of the summer crop. Indeed the winter crop is raised chiefly with the view of using the produce as seed, and only what is left over after providing seed for the first crop of the following year finds its way to the market. The average yield of the summer crop is believed to be about five times the quantity of seed used, and that of the winter crop twice. The Khasias prefer the produce of the second crop as seed for the main crop of the following year. The tubers which are gathered in November-January remain fresh and in good condition till the planting time in February-March, while those of the summer crop, if retained for seed for the same crop of the succeeding year, are more or less shrivelled up, and a considerable proportion of them is lost through rotting. Such tubers are also weakened to some extent through premature sprouting while in store. These sprouts are useless and have to be rubbed off. The Khasias occasionally use summer seed for their main crop, when for any reason they are unable to raise a winter crop or obtain seed from that crop by purchase.

Up till 1905 the practice at the Farm had been to grow only a single crop of potatoes during the year, namely, the summer crop, consequently no winter-grown seed was available for sowing, and all the seed potatoes used came from the main crop of the preceding year. The winter crop was raised for the first time last year (1906). A portion of the produce of each of the 25 varieties of potato grown in 1906 was planted for the winter crop in August. The yields, however, were very small. Most varieties barely returned the seed sown, while a few gave 2 to 3 times the quantity sown. The produce was saved and used as seed for the summer crop of the season under report. Many of these varieties were evidently unsuited for the second crop. The tubers of these varieties proved so slow to sprout that a great proportion of the tubers failed to germinate till the season was too far advanced, and many remained dormant through the winter.

I had two objects in veiw in growing the winter crop of potatoes last year. The first was to raise seed for the summer crop of 1907 and the second was to ascertain by comparative trials to what extent winter-grown seed is more productive than seed obtained from the summer crop preceding. These trials were made with two of the best varieties we possess—Magnum Bonum and King Edward VII. The crop was planted on the same date and received the same treatment as the crop in the variety experiment described in paragraph 6. The yields were as follow :—

Variety.	Kind of seed used.	Area planted.	Actual yield.	Yield per acre.
1	2	3	4	4
		Acre.	Mds. srs.	Mds.
Magnum Bonum ...	Summer seed ...	$\frac{1}{40}$	4 34	194
Ditto ...	Winter „ ...	$\frac{1}{40}$	6 17	257
King Edward VII ...	Summer „ ...	$\frac{1}{80}$	1 15	110
Ditto ...	Winter „ ...	$\frac{1}{80}$	3 1	242

The difference in favour of the winter-grown seed was 63 maunds in one case and no less than 132 maunds in the other and bears out the wisdom of the local practice of raising a special seed crop in winter for the sake of the summer crop which follows.

Rape-cake as manure for potato.

10. The use of oil-cake as manure for potatoes was proved by numerous experiments made in past years at the Experimental Farm and there was no object in repeating the experiment except as a fresh demonstration of the usefulness of this manure. The experiment was made in duplicate in small beds each $\frac{1}{160}$ of an acre. There were four beds all of which were manured with 800 baskets of cowdung to the acre ; two received 20 maunds of rape-cake per acre

besides the cowdung the other two received no cake. The yields of the four beds were as follows:—

Manure per acre.	Yield of bed.		Yield per acre.
1	2		3
First series.	Mds.	srs.	Mds.
Cowdung 800 baskets	0	33	132
„ +20 maunds of rape cake	1	11	204
Second series.			
Cowdung 800 baskets	0	37	148
„ +20 maunds of rape cake	1	12	208
Average of 2 series.			
Cowdung 800 baskets	0	35	140
„ +20 maunds of rape cake	1	11½	206

The average increase in yield due to the use of the oil-cake was 66 maunds per acre valued at Rs. 132 at the rate of price now prevailing. The cost of the 20 maunds of oil-cake was Rs. 70, and the cost of crushing it for use Rs. 2-8, total Rs. 72-8. The use of the oil-cake, therefore, resulted in a net gain of Rs. 59-8.

The price of oil-cake has risen lately from Rs. 2 to as high as Rs. 3-8 per maund. At the same time the price of potatoes this season is considerably higher than in ordinary years. It is now about Rs. 2 per maund which has been taken by me for calculating the value of the yields obtained this year. In former years, the price of potatoes in the harvesting season varied from Re. 1 to Re. 1-8 per maund. Taking oil-cake at its present high price, it is doubtful if its use will cover more than the actual cost of the manure in seasons when potatoes will be selling at its usual harvest price of (say) Re. 1-4 I would not recommend the use of this manure in the Khasi Hills unless it could be obtained at Rs. 2-8 or under per maund.

Preservation of fodder in silos.

11. Silo-making has been an established practice at the Farm for many years past. Three box and one pit silos were filled during the year partly with maize and Jobs'-tears

grown on the Farm and partly with wild grass. The silos were filled in the latter part of August and the beginning of September. The total quantity of green fodder placed in the silos was 1,034 maunds. The silos were opened one after another during the winter, and the silage fed to the cattle and pigs on the Farm. Out of the 1,034 maunds ensiled, 445 maunds or 43 per cent. was recovered as good silage; 330 maunds or nearly 33 per cent. was rejected as unfit for use and the remainder 24 per cent. represented loss of weight through dryage. The loss through rotting and dryage was more last year than in the previous year. The total cost of the 445 maunds of silage actually obtained was Rs. 292-14 inclusive of the cost of growing the maize and jobs' tears and collecting the grass from the jungles. The cost per maund came to 10 annas 6 pies per maund against 7 annas 5 pies in the preceding year. The greater cost was due to a larger proportion of the stored fodder having been lost through rottage.

Breeding of cattle.

12. At the close of the year the Farm herd comprised the following head of cattle —:

——	Patna (half English.)	Khasia (pure).	Khasia cross-bred (Patna-Khasia).	Bhutia (pure).	Bhutia cross-bred (Patna-Bhutia).
1	2	3	4	5	6
Cows	10	19	...	2	...
Bull	1	...	...	...	...
Heifers	7	...	12	...	2
Steers (young bulls) .	2	...	4	...	...
Bull-calves ...	4	...	5	...	...
Heifer calves ...	4	...	7	...	1
Total ...	28	19	28	2	3

Total 80 against 66 in 1905-1906. Besides there were two bullocks for plough and cart work.

The demand for Patna cattle from Khasias continues. Seven young bulls were sold during the year, all to Khasias, at prices varying from Rs. 10 to Rs. 20 per head. The price charged was fixed purposely low in order to encourage people

to take these animals. I think a higher price can be now obtained. The Farm is unable to meet all the requisitions for young animals that have been received. We are not selling heifers at present, but are retaining all for increasing our own herd. Requisitions for Patna heifers are received from time to time but cannot be met for some time to come. Among the cows are two pure Patna animals bred on the Farm. They have turned out fairly good milkers, the daily yield of milk when in full flow averaging 4 to 5 seers for each. Cattle food is very dear at Shillong; the rations given to the cows are, therefore, on a much less liberal scale than what the best class of cows are allowed in the plains. If liberally fed some of the Farm cows can be easily made to yield 8 to 10 seers of milk daily.

None of the cross-bred Khasia and Bhutia heifers have calved as yet. There are some very promising animals among these. The total cost of maintaining the herd during the year amounted to Rs. 2,48--8-3 as detailed below—

	Mds.	srs	ch.	Rs.	a.	p.
Oilcake	279	18	14	932	8	4
Matikalai	66	8	5	340	9	10
Salt	11	20	15	52	6	4
Grass	1,385	16	5	327	6	3
Value of Farm produce given.						
Silage	395	25	0	259	10	0
Sweet potato (tubers and suckers)	73	12	0	57	0	0
Milk for calves	2	0	12	8	15	6
Wages of cowherds (4 men) ...		...		504	0	0
Total		...		2,482	8	3

The cost was Rs. 2,410-3-9 in 1905-1906.

The total outturn of milk during the year was 197 maunds $25\frac{3}{4}$ seers, valued at Rs. 894-5-10. The corresponding figures for the preceding year were 153 maunds $2\frac{3}{4}$ seers of milk, valued at Rs. 680-5-0. Besides, a sum of Rs. 85 was realized during the year by the sale of young Patna bulls.

English pigs.

13. The English pigs, a herd of which has been maintained at the Farm since December 1902, have failed to become popular among the Khasias. There is no object in maintaining the herd longer. It contained 14 animals at the close of the year. The cost of maintaining it during the year amounted to Rs. 417-6-11. It is proposed to dispose of the whole herd by sale. Five pigs were sold during the year for Rs. 33. They were purchased ostensibly for slaughter.

Introduction of agricultural improvements.

14. The following agricultural improvements have been proved by repeated trials at the Experimental Farm, and efforts are being made by the Department to introduce them to the notice of the cultivators in the Khasi and Jainta Hills—

(1) The value of oilcake as a manure for potato;
(2) The preservation of fodder in silos; and
(3) The breeding of Patna cattle.

Vernacular leaflets on these improvements have been published and circulated in the district. Other measures taken to popularize them are noted below:

Use of oilcake as manure.—As an incentive to the use of oilcake small quantities of rapecake were distributed free among Khasia cultivators in 1905-06 and again during the year under report. The recipients were asked to use it on small plots along side of land which received no oilcake, and no report was asked for. It is expected that if they find the manure useful, some of them at least will be willing to purchase it in future. Three maunds and 35 seers of cake was given out during the year to 17 Khasia cultivators. The Overseer of the Farm has interviewed 14 out of the 17 recipients. None of them kept any record of the yield obtained from the plots manured with oilcake, but most of them were satisfied with the result, and some expressed a desire to use oilcake next year.

Silo-making.—To encourage silo-making the Department has been awarding prizes for silos to Khasia cultivators for the last three years. During the year under report seven silos are known to have been made by Khasias, five of which competed for the prizes. Five competed in 1905-06 and 12 in 1904-05. Out of the five competitors in 1906-07, one was awarded a chaff-cutter as the first prize and two others received rewards of Rs. 10 and Rs. 5 respectively. The silos were made in September. The materials used consisted for the most part of chopped maize stalks without cobs. The silos were judged by me in January last. It does not appear that silo-making is making appreciable progress in these hills. It is feared the few men who made silos and competed for the prizes last year, were attracted more by the prospect of reward than by any benefit which they might derive from the use of preserved fodder. The Department has not offered any prize this year, and it will be seen shortly whether the fear is groundless or not.

Breeding of Patna cattle.—Mention has already been made of the distribution of young Patna bulls or rather bull calves among the Khasias.

It is time now to introduce a fourth agricultural improvement to the notice of the Khasias, namely, the use of Bordeaux mixture as a remedy for the potato blight. The efficiency of the remedy has been proved over and over again at the Farm. The difficulties which evidently stand in the way of the Khasias adopting this improved practice are the cost of the spraying outfit which costs about Rs. 50 and want of means in the interior of the country for repairing them. These difficulties may be overcome by the adoption of a system of hiring out the apparatus similar to the system which has so successfully worked in the plains districts in the case of sugarcane mills. A better plan would be to create agricultural societies in different parts of the district who would keep a stock of improved agricultural implements and hire them out to the members as occasion requires. Such societies might help agricultural improvements in many other ways, for example, their functions might very usefully extend to the helping of the peasants with advances of money for the purchase of manure, seed, cattle and other agricultural requisites. I have digressed into a rather large subject but I feel almost convinced that there is little prospect of agricultural improvements diffusing rapidly enough among the people unless some such organizations as I have indicated above, be brought into existence. Whether such organizations are possible in the low state of knowledge and enterprize which obtains among the masses is by no means certain, but it is a point which I think the Agricultural Department should try to make clear.

Distribution of seeds and manures.

15. The following seeds and manures were supplied by the Farm during the year :—

Potatoes—90½ maunds to 9 Khasias and 7 others ; Maize 21 seers to 3 non-Khasias and rapecake 3 maunds 35 seers to 17 Khasias.

Receipts and expenditure.

16. The receipts of the Farm amounted to Rs. 692-14-2 against 852-10-9 in the preceding year. Besides this amount, a sum of Rs. 1,917-1-9 was deposited into the treasury as the balance in hand of the Government dairy which was sold to messrs. Golam Hyder & Sons in 1904-05.

The total expenditure during the year amounted to Rs. 4,559-13-8 against Rs. 5,821-3-8 in the previous year.

Management.

17. As already stated, the Farm and the Fruit Garden are managed by the same staff. It consists of a Superintendent on Rs. 60, an Overseer on Rs. 25 to Rs. 40, and a Fieldman Clerk on Rs. 25 to Rs. 40. The Overseer, U Hari Singh, was appointed towards the close of the year and the Fieldman Clerk on 17th September 1906. Mr. Herrick Sing, the Superintendent, supervises the Tropical Plantation at Wahjain, besides being in immediate charge of these two stations. He worked well during the year.

B. C. BASU

Assistant Director of Agriculture,

Dated 27th July 1907. *Eastern Bengal and Assam.*

SHILLONG : Printed and published by E. HILL, Press Superintendent, Eastern Bengal and Assam, at the Secretariat Printing Office : (Agri.) No. 115—500—4-1-1902.

132931

ANNUAL REPORT OF THE AGRICULTURAL STATIONS

IN

EASTERN BENGAL AND ASSAM

FOR THE

Year ending the 30th June 1908.

SHILLONG:

PRINTED AT THE EASTERN BENGAL AND ASSAM SECRETARIAT PRINTING OFFICE.

1909.

Price 1 *Shilling.*] [*Price* 12 *annas.*

Agents for the Sale of Books published by the Eastern Bengal and Assam Government.

Agents in India.

(1) Messrs. Thacker, Spink & Co., Calcutta.

(2) Messrs. W. Newman & Co., Calcutta.

(3) Messrs. S. K. Lahiri & Co., Calcutta.

(4) Messrs. A. M. and J. Ferguson, Ceylon.

(5) Messrs. R. Cambray & Co., 6 and 8/2, Hastings Street, Calcutta.

(6) Messrs. Thompson & Co., Madras.

Agents in England.

(1) Mr. E. Arnold, 41 and 43, Maddox Street, Bond Street, W., London.

(2) Messrs. Constable & Co., 16, James Street, Hay Market, W., London.

(3) Messrs. Kegan Paul, Trench, Trübner & Co., Gerrard Street, Soho, W., London.

(4) Mr. B. Quaritch, 15, Piccadilly, W., London.

(5) Messrs. P. S. King & Son, 9, Bridge Street, Westminster, S. W., London.

(6) Mr. B. H. Blackwell, 50 and 51, Broad Street, Oxford.

(7) Messrs. Deighton Bell & Co., Cambridge.

(8) Messrs. Henry S. King & Co., 65, Cornhill, E. C., London.

(9) Messrs. Grindlay & Co., 54, Parliament Street, S. W., London.

(10) Mr. T. Fisher Unwin, 1, Adelphi Terrace, London, W. C.

Agents on the Continent of Europe.

(1) MM. Friedländer & Sohn, 11, Carlstrasse, Berlin.

(2) M. Otto Harrassowitz, Leipzig.

(3) M Karl Hiersemann, Leipzig.

(4) M. Ernest Leroux, 28, Rue Bonaparte, Paris.

(5) Martinus Nijhoff, The Hague.

(6) Mr. Rudolf Haupt, Halle-a-S., Germany.

SHILLONG:

PRINTED BY E. HILL, PRESS SUPERINTENDENT, EASTERN BENGAL AND ASSAM.

PREFACE.

Rai B. C. Basu Bahadur, Assistant Director of Agriculture, expected to be able to publish the reports of the agricultural stations for 1907-08 before taking furlough in July 1908. When it was found that many of the necessary statements were not ready in time, he generously volunteered to complete the reports during his leave. But unfortunate circumstances prevented him from carrying out this intention, and after some time the papers were returned incomplete. His *locum tenens*, Mr. A. G. Birt B.sc., has therefore written the whole of the Burirhat, Shillong, Wahjain, and Upper Shillong reports and considerable portions of those of Rangpur and Rajshahi. Knowing very little of the work that had been done during the year, the writing of these reports has been a severe tax on an officer new to duties of this kind and overburdened with the supervision of seven agricultural stations, most of them newly started and all undermanned.

To the above circumstances is due the delay in the appearance of these reports. A proposal has recently been submitted to Government for the appointment of a separate Deputy Director. If this is sanctioned there will be more than ample work for the additional officer and future reports can be expected to issue more punctually.

Camp Jorhat ;
The 9th February 1909.

S. G. HART,
Director of Agriculture,
Eastern Bengal and Assam.

CONTENTS.

ANNUAL REPORT OF THE DACCA AGRICULTURAL STATION.

	Pages.	Paragraphs.
History and description of the Farm ...	1-2	1-3
Laying out and equipment of the farm ...	2-4	4
The endless band pump, etc. ...	4	5
Establishment	5	6
Cultivation in 1907-1908, experiments with Bone meal sweepings as manure for rice, etc.	5-8	7
Accounts	8-9	8

ANNUAL REPORT OF THE RANGPUR AGRICULTURAL STATION.

History, description and equipment ...	11-13	1-5
Character of the season and crops grown during the year. ...	13-20	6-10
Experiments in tobacco cultivation ...	20-22	11
Notes on the characters of several varieties of tobacco ...	22	12
Production of self fertilised seed ...	22-23	13
Valuation of the tobacco produced on the farm.	24-28	14
Manufacture of cigars and cigarettes ...	28-29	15
Experiments in ginger cultivation ...	29-31	16
Experiments in potato cultivation ...	32-33	17
Other crops ...	33	18-19
Miscellaneous	33-34	20-24

ANNUAL REPORT OF THE BURIRHAT AGRICULTUARL STATION.

History, description and equipment ...	38	1-3
Crops ...	38-40	4
Tobacco experiments ...	41-43	5-8
Miscellaneous ...	43	9

ANNUAL REPORT OF THE RAJSHAHI AGRICULTURAL STATION.

	Pages.	Paragraphs.
History and description ...	45-47	1-8
Crop experiments of the year ...	47-49	9-10
(*a*) Central Provinces fine *aus* ..	50-51	11
(*b*) Dacca Gandari sugarcane ...	51-54	12-13
(*c*) Mazaffarnagar wheat ...	54	14
(*d*) Sugarcane manured with castor cake and with super *plus* saltpetre...	55-56	15
(*e*) Wheat on green-manured land	56-57	16
(*f*) Potatoes	58-61	17
(*g*) Jute	61-62	18
(*h*) Malancha	62	19
(*i*) Sida	62-63	20
(*j*) Gram and other non-experimental crops	63-64	21
Sugar-making with the Hadi apparatus	65-66	22
Seed-distribution, new implements, etc.	66-67	23-26

ANNUAL REPORT OF THE JORHAT AGRICULTURAL STATION.

Object, history and description of the Station	69-71	1-6
New implements tried	72-74	7
The season	74-75	8
Sugarcane experiments to ascertain the best varieties and the most profitable form of manuring	75-87	9-16
Fruit trees	87-88	17
Inspection and accounts	88-91	18-19

ANNUAL REPORT OF THE SHILLONG FRUIT EXPERIMENT STATION.

	Pages.	Paragraph.
History and description ...	93-95	1-2
Particulars of fruit trees and grafts ...	95-96	3
Weather	97	4
Progress of fruit trees	97-99	5
Treatment of fruit trees	100	6
Diseases	100	7
Strawberries	100-101	8
Other crops	101	9
Sericulture	102-105	10
Mulberry cultivation	105	11
Distribution of plants	105-106	12
Receipts and expenditure	106-107	13

APPENDIX—Giving particulars of various species of fruit trees.

ANNUAL REPORT OF THE UPPER SHILLONG AGRICULTURAL STATION.

Introductory, history and description of farm	137-138	1-2
Weather	138	3
Work done during year ...	139	4
Potato experiments	139-150	5-12
Silage	150	13
Cattle	150-152	14
Demonstrations	152-154	15
Receipts and expenditure ...	154	16
Management	154	17

ANNUAL REPORT OF THE WAHJAIN AGRICULTURAL STATION.

History and description	155-158	1-4
Distillation of lemon grass oil ...	158-161	5
Plants under trial—		
Camphor, coffee, cinnamon, cardamom, lemon grass, nutmeg etc.	161-162	6-13
Plant diseases—		
Of fungus, diecase of cardamoms ...	162-163	14
Orange blight	163-164	15
Miscellaneous	164-170	16-17

ANNUAL REPORT OF DACCA AGRICULTURAL STATION FOR 1907-1908.

Introduction.

The following is an account of the work done at this station from its inception to the end of the agricultural year 1907-1908. The site of the Farm was selected by me in December 1906 and was approved, after inspection, by the late Lieutenant-Governor, Sir Bampfylde Fuller and the Officiating Inspector General of Agriculture, Mr. F. G. Sly.

Besides serving as an experimental station, the Farm will be the headquarters of the expert staff of the Department. For the present, no educational institution will be associated with the Farm, but it is proposed to maintain a class under the Superintendent of the Farm for the training of practical fieldmen who will conduct agricultural demonstrations on Government and Wards' estates, and assist Agricultural Associates in making such demonstrations.

Description of the Farm.

2. The Farm comprises a compact block of land 353·72 acres (equal to 1,070 bighas) in area, situated between the Mymensingh and Mirpur roads, about 5 miles to the north of Dacca town and about 2 miles north of the race-course. The land has been acquired at a cost of Rs. 70,043. It came into our possession partly in July 1906 and partly in the following November. At the time of the acquisition, the greater portion of the area was under thatching grass, scrub jungle and mango topes, the remainder being cultivated land. A large area of jungle land has since been reclaimed and the greater part has been levelled and laid out in uniform plots each measuring one bigha (120′×120′). At present, the area of the farm is divided approximately as follows:—

	Bighas.	
Low land suitable for winter rice ...	210	Out of this, 164 bighas is ravine land, *i.e.*, narrow strips winding between ridges of high land. The rest is open lowland.

High land—

	Bighas.
Levelled and plotted out ...	180
Cleared but not yet levelled or plotted out	270
Mango topes	70
Thatching grass, pasture and scrub jungle	130
Sites for buildings, roads and paths	135
Tanks	50
Unculturable waste (brick field etc.)	25
	860
Total	1,070

Soil.

3. The soil of the Farm belongs to the formation known as the old alluvium. This formation extends over a considerable tract, known as the Madhupur jungle and appears also in the *Barind* or *khujar* tract in Rajshahi division. The characteristic soil of this formation is a red clay which sets hard like cement. The soil of the Farm has not yet been analysed. The low fields which receive the washings from the high ridges between which they lie are usually productive, but the high land is, as a rule, of very poor quality and does not admit of being profitably cropped for more than 2 or 3 years.

Laying out and equipment of the Farm.

4. As already stated, we obtained full possession of the land in November 1906. Since then our attention has been principally confined to equipping the Farm with buildings and roads, reclaiming land from jungle and bringing it into a condition suitable for experimental purposes. A great deal of work has already been done in those directions, but much more remains to be done.

It is hardly to be expected that the Farm will be fully equipped for the work it is intended to do before the end of another two years. The construction of buildings and road costing more than Rs. 2,500 has been entrusted to the Public Works Department, the smaller houses and roads being made under the management of the Superintendent of the Farm. The principal items of work completed up to the close of the agricultural year 1907-1908 are noted below.

A Farm steading has been erected by the Public Works Department at a cost of Rs. 28,750. It comprises a cattle shed (providing accommodation for 60 head of cattle), several large godowns, the Farm Office, a carpenter's and blacksmith's shop and accommodation for a chaukidar and two bullock keepers. The building was completed and made over to us at the end of 1907.

Two roads 20 feet wide have been made, traversing the Farm from north to south and from east to west. They have an aggregate length of 2,650 yards. About 800 yards has been metalled, and the metalling of the remainder will be soon taken in hand. The 800 yards already metalled was made by the Public Works Department at a cost of Rs. 4,957; the remainder has been made under our own management. Besides these two mains roads, minor roads aggregating 3,060 yards in length have been made. Some of these are 10 feet and others 8 feet wide.

The Farm has been enclosed with a wire fence at a cost of Rs. 7,000. The materials of the fence were supplied by Messrs. Main & Co. of Calcutta.

Nearly 200 bighas of high land have been cleared of jungle. The greater part of this area has been levelled and laid out into plots, each 120′×120′. One hundred and fifty-four plots in all have been prepared up to date, and some fifty more will soon be ready. These plots are separated from one another by footh-paths, 3 feet wide, and between every two rows of plots there is a space of 9 feet, consisting of a drain 3 feet wide with a 3 feet path on each side of the drain.

A house for the accommodation of the Agricultural Supervisor who will ultimately be put in charge of the Farm has been constructed at a cost of Rs. 2,500. Quarters for a fieldman clerk and two overseers were under construction at the end of the year, in addition to residences for the Supernumerary Farm Superintendent and the Entomological Collector who will have their headquarters at Dacca, are now under construction. Besides the foregoing houses which are being erected under Departmental management, the Public Works Department has in hand the construction of a laboratory and residences for the Expert Staff of the Department who will have their headquarters on the Farm.

The Farm contains a large tank and several smaller ones, but all had become silted up. It is proposed to reclaim the large tank and one or two of the smaller ones. The work of deepening the large tank was started in April last,

but had to be left incomplete owing to a heavy downpour early in May which filled the tank and made further progress during that season impossible. The work will be finished during the next cold weather.

Great difficulty was experienced at the outset in securing coolies and work had to be stopped at times for want of labour. The difficulty has been overcome by settling some thirty families of Sonthal and Buna coolies on the Farm. These men have been provided with huts erected for them at the cost of the Farm. Most of these huts were inherited by the Farm from the tenants who held the land previous to its acquisition by Government. There are altogether thirty-four huts, and they are now situated on new sites along the boundaries of the Farm, so that it is guarded on every side. At suitable intervals, kutcha wells lined with earthen rings have been dug to supply drinking water for the coolies, who seem contented and happy.

The mango groves had become overgrown with jungle. It is proposed to remove the jungle and all dead or decaying trees and to clear the remaining trees of the parasitic and epiphytic growths with which they are infested. Blank spaces in the groves will be planted with grafted mangoes. It is hoped the groves will improve greatly under this treatment. Some of the groves have been already cleared of jungle and the rest of the work will soon be taken in hand.

Cattle and implements.

5. The Farm is at present possessed of only three pairs of cattle. The Superintendent of the Veterinary Department was requested to purchase eight pairs more of cattle for the Farm, but has not yet been able to do so.

The Farm has in stock four Hindustani ploughs, a knapsack spraying machine, and a large number of country implements. None of the improved implements have been used as yet. A water lifting pump invented by Pilter, London, and recommended by the Secretary of State, was obtained for trial on the Farm at a cost of £8-19-8. The pump consists of a wheel over which an endless jute band about 4 inches wide runs. The band is just long enough to allow the lower part of it to reach the water. The pump has been tried twice on the Farm, once at a depth of some 20 feet, and again when the water level was about 3 feet from the surface. Neither trial was at all successful, but a fresh experiment will be made at a greater depth, arranging the band so that it just touches the surface of the water.

Establishment.

6. The sanctioned establishment of the Farm consists of :—

A Superintendent of the rank of an Agricultural Supervisor, Rs. 250—10—100	... 1
Overseers on Rs. 30—2—50	... 2
Fieldman clerk on Rs. 25—1-8—40 ...	... 1
Peon, Rs. 8	... 1
Durwan, Rs. 10	... 1

A permanent Superintendent has not yet been appointed but Babu Kali Das Roy, Farm Superintendent, has been in charge of the farm since it was started. He came to Dacca in March 1906 and for some months previous to the taking over of the Farm, he was employed in surveying the land and preparing a record-of-rights. Two overseers and a fieldman clerk have been appointed, but one overseer has since been transferred to Jorhat as Farm Superintendent and at the end of the year, the fieldman clerk was at Pusa undergoing six months' special training to qualify him for appointment as an overseer.

Cultivation in 1907-1908.

7. No systematic experiments could be undertaken in 1907-1908 as the farm had neither cattle nor implements. A few simple experiments were made on small areas of land with a view to test whether certain crops could be grown on the soil of the Farm. These were wheat, barley, oats, gram, potatoes and flax. The first four crops were sown on the 27th October. The seed germinated well, but the plants failed to make growth and gradually died out. The soil was dry and there was no rain for weeks in October and November, which might account for the failure of the crops.

Potatoes were grown on a patch of land measuring about a cottah ($\frac{1}{60}$th of an acre). It was manured with a heavy dressing of cowdung (600 maunds per acre). The crop was planted in the middle of October and irrigated once. The yield was poor about 70 maunds per acre but the experiment left no doubt that potatoes could be grown successfully with irrigation the soil of the Farm.

Half an acre of Russian flax was grown under Mr Finlow's direction. The land was manured with castor cake at the rate of 7 maunds to the acre, and was ready for sowing at the end of October, but as the seed sent by Mr. Finlow from Pusa arrived late, the sowing was not done till the

middle of November. The seed germinated very well and in spite of the dryness of the soil, the plants grew two to three feet high. When the crop was about to be reaped, Mr. Finlow found a few plants attacked by a species of dodder, which is extremely injurious to flax in European countries, and in order to nip the pest in the bud, he directed the entire crop to be destroyed by fire. This was done, except that 12 bundles of plant were sent to Pusa for Mr. Finlow's inspection.

At the request of Mr. Morgan, Chairman of the Narayanganj Chamber of Commerce, an experiment was made to test the manurial efficacy of bone-sweepings offered for sale by the Ganges Bone-mills, Calcutta. The crop on which they were tried was transplanted winter rice. There were three different qualities of sweepings, called SA, SB, and BS, and their nitrogen contents were given as follow :—

SA	...	...	2·6 lbs. per maund
SB	...	...	2·3 „ „
BS	...	...	2·0 „ „

The manures were used at the following rates :—

SA	...	...	6 maunds	per acre.
SB	...	...	7 „	
BS	...	...	8 „	

There were seven plots of rice (*sali*) land disposed and manured as shown in the sketch below :—

No manure.	SA.	No manure.	SB.	No manure.	BS.	No manure.
1	2	3	4	5	6	7
Acre.	Acre.	Acre.	Acre.	Acre.	Acre.	Acre.
·23	·22	·13	·08	·13	·16	·02

All the manure was applied to the land on 20th July and the crop transplanted one week later. Better results would have been shown if the manure had been applied a month or six weeks earlier. As it was, the SA and SB,

manures gave substantial increases in outturn, BS alone showed a decrease. The average yields were as follow :—

—	Yield of grain per acre.	Increase (+) or decrease (—) as compared with average of the two unmanured plots on each side.
1	2	3
	Mds. srs. ch.	Mds. srs. ch.
Plot No. 1 No manure ...	23 8 12	+9 32 2
„ 2 SA	36 14 8	
„ 3 No manure ...	29 36 0	+6 10 8
„ 4 SB	36 16 0	
„ 5 No manure ...	30 15 0	
„ 6 BS	24 27 8	—4 18 12
„ 7 No manure ...	27 37 8	

The decrease in outturn in the case of BS, cannot be accounted for. The land to start with was uniform as far as could be judged by the eye.

The cost of the three manures inclusive of freight was as follows :—

	Rs. a. p.
SA, 6 mds. at Re. 1-8	9 0 0
SB, 7 mds. at Re. 1-2	7 14 0
BS, 8 mds. at Re. 1	8 0 0

The value of the increase in yield was :—

	Rs. a. p.
In case of SA+9 mds. 32 srs. 2 ch. at Rs. 2-14 per md.	+28 2 9
In case of SB, 6 mds. 10 srs. 8 ch. at Rs. 2-14 per md.	+18 0 0
In case of 4 mdsS,. 18 srs. 12 ch. at Rs. 2-14 per md.	—12 6 6

Therefore the net profit or loss from the use of the several manures were as below :—

	Rs.	a.	p.
SA profit	19	2	9
SB profit	19	2	0
BS loss	20	6	6

As we had no means for cultivating it, the entire area of low land, with the exception of the small area used for the experiment with bone sweepings, was let out to rayats for the season on the half-share system. The total area let out was 148 bighas which brought to the Farm a gross return of 500 maunds, 26 seers of paddy. Out of this quantity, 55½ maunds had to be refunded to the raiyat on account of seed, leaving a net income of 445 maunds, 6 seers of paddy as rent for the land. Of this amount, 425¼ maunds was sold for a sum of Rs. 1,177-10-0; 4 maunds 29 seers was stored for seed and 15 maunds 6½ seers was lost through dryage. The upland area remained uncultivated last year with the exception of the small plots sown with flax, potatoes and cereals.

Receipts and expenditure.

8. The receipts of the Farm from its commencement to the end of June 1908 amounted to Rs. 2,406-13-3 and were derived as follows.

	Rs.	a.	p
Sale of thatching grass	214	10	0
Grazing dues	395	2	0
Sale of fuel	331	2	3
Sale of agricultural produce	1,180	6	9
Sale of fruit	163	12	0
Sale of seeds	87	0	3
Miscellaneous sources	34	12	0
Total ...	2,406	13	3

The expenditure during the same period (exclusive of the work carried out by the Public Works Department) amounted to Rs. 21,050-10-11 and was made up as follows :—

	Rs.	a.	p.
Establishment	8,431	15	10

Capital charges—

Buildings constructed under Departmental management	4,532	3 9	(Rs. 900 out of this amount was subsequently refunded to the Treasury).
Reclamation	1,351	1 3	
Deepening of a tank	513	9 9	
Roads, drains, etc.	1,207	0 6	
Live-stock	1,287	11 6	
Implements	530	8 0	
	9,422	2 9	9,422 2 9

Contingent charges—

Labour (principally in levelling and ploting)	5,901	11 7	
Erection and repairs of coolie huts	817	5 0	
Repairs to roads, etc.	16	0 0	
Purchase and repairs of country implements and furniture	506	13 6	
Manure	90	1 6	
Seeds and plants	272	7 3	
Railway freight on manures and seeds and plants	15	10 0	
Cattle food	87	6 0	
Stamps	53	0 0	
Telegrams	16	0 0	
Miscellaneous	420	1 6	
	8,196	8 4	8,196 8 4
Total			21,050 10 11

ANNUAL REPORT ON THE RANGPUR AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1908.

History and description of the farm.

THE Rangpur Farm has been in existence since April 1905. The farm is situated within the limits of Rangpur town and consists of a long strip of land runing east to west, having an area of about 20 acres. Of this area, about 4 acres is high land more or less suitable for the cultivation of tobacco which has been the main crop of the farm. About 3 acres along the north boundary of the farm is low *bil* land suited only for the cultivation of marsh rice. The rest is moderately low land in which transplanted winter rice and jute can be grown. The surface of the farm has a general slope from south to north and from west to east.

2. The district of Rangpur contains perhaps the most important tobacco growing area in the whole of India; but the tobacco produced in the district is of a coarse description unfit for manufacture into cigars and cigarettes such as would find acceptance with European smokers, though it is used to some extent in the manufacture of low-grade cigars and cigarettes for Indian consumption. The experience gained on the Rangpur Farm during the last three years gives reason to hope that good cigar and cigarette tobaccos may be produced in this district.

3. The Rangpur Farm lies outside the true tobacco growing belt. Its soil contains more less sand and is more retentive of moisture than the typical tobacco soil of the district. It was accordingly decided two years ago to transfer the tobacco research work from the Rangpur Farm to a new station, Burirhat, 5 miles to the north of Rangpur town and within the tobacco belt. During 1907-1908 the Burirhat Station was partly filled up for experimental work and a portion of the programme of tobacco experiment as carried out at that station; the major portion of the experimental work was, however, done at Rangpur.

The management of the Rangpur Farm has since the close of the year, passed into the hands of the local Agricultural Association, but the Government will continue to make a grant towards its maintenance and the Association will follow the advice of officers of this Department in regard to the management of the farm.

The soil of the farm.

4. The soil is a rich, moist loam of light texture, very easily worked and always in good heart for tobacco; it is perhaps too moist and not light enough. The sub-soil to a depth of 3 or 4 feet is, however, almost pure sand. A sample of soil taken from the tobacco growing portion of the farm was analysed during the year by the Imperial Agricultural Chemist at Pusa. Dr. Leather's report on the composition of the soil is as follows :—

Mechanical Composition

	Diameter.	per cent.	
Clay	smaller than ·002		·74
Sand	... „ ·002— ·004	3	·81
„	... „ ·004— ·008	5	·76
„	... „ ·008— ·016	8	·78
„	... „ ·016— ·032	28	·59*
„	... „ ·032— ·120	42	·25
„	... „ ·120	5	·90
		95	·83
Organic matter and combined water		... 4	·17
		100	·00

This soil is similar to the Ganges alluvium and is a thoroughly open soil.

Chemical Composition,

Carbonate of lime	...	...	·091
Organic nitrogen	...	...	·101
Available phosphoric acid	...	...	·093
Available potash	...	...	·065

The soil contains very little carbonate of lime, but is unusually rich in nitrogen, phosphate and potash. If it is regularly manured with farmyard manure, it should pay to lime it once in about 10 years.

Equipment.

5. The farm is provided with quarters for the Superintendent, two coolie sheds and a cattle shed. The coolie and cattle sheds were greatly damaged by a severe hailstorm in April 1907, and are in a bad state of repair. The farm has all along suffered greatly from want of proper curing and fermentation houses and as it has been decided to transfer all tobacco work eventually to the Burirhat farm, no steps were taken to

supply these deficiencies at the Rangpur Farm. As in 1906-1907, the tobacco crop of 1907-1908 was cured and sweated in a corrugated iron shed in which no means existed for regulating the temperature and humidity of the air. Suitable houses for curing and fermentation were erected during the year at Burirhat, but these, being 5 miles away, were not available for the use of the Rangpur Farm.

Character of the season.

6. As this report deals with crops harvested during the rainy season of 1907 and the following *rabi* season, it is necessary to consider the distribution of rainfall during the thirteen months from April 1907 to April 1908. The statistics are as follows:—

	Actual.		Normal.	
	Rainfall, in inches.	Number of rainy days.	Rainfall, in inches.	Number of rainy days.
1	2	3	4	5
1907.				
April	3·70	6	3·16	4·30
May	12·69	12	10·37	11·10
June	15·16	24	19·95	15·70
July	18·40	24	15·93	15·4
August	4·29	17	13·02	13·3
September	18·64	20	14·18	13·5
October	0·49	2	4·94	4·0
November	*Nil*	*Nil*	0·24	0·1
December	0·05	1	0·08	0·2
1908.				
January	0·042	2	0.49	0·9
February	0·81	3	0·43	1·1
March	0·08	2	1·16	1·6
Total of 1907-1908	74·352	113	83·95	81·2
April	2·66	4	3·16	4·3

The season was favourable for tobacco. The rain in January and February proved particularly helpful to the crop. The rice crop, on the other hand, suffered greatly from adverse weather. Heavy rain from the middle of May to the beginning of July damaged the crop on the *bil* lands. This was followed by a long spell of dry weather which lasted till the latter part of August and seriously interfered with transplanting operations. A part of the rice area had consequently to be left unplanted. Good rain was received in the latter part of August and the first week of September, but the monsoon withdrew soon after, and a long period of rainless weather followed, which materially diminished the yield of rice.

Crops grown during the year.

7. The crops grown during the year were as follows:—

Experimental.

Tobacco	1·400 acres.
Ginger	0 255 „
Potato	0.400 „
Oats	2·020 „
Cow-pea for green manure ...	0 200 „

Non-experimental.

Rice	9·445 „
Jowar for fodder	0·540 „
Maize „ „	0·140 „
Total	14·410 „

Tobacco.

8. The following table shows the different varieties of tobacco grown during the year, the method of cultivation and the yields obtained from each :—

Serial No.	Class of tobacco.	Variety.	Source of seed.	Area, in acres.	Rotation.	Manure, per acre.	Time of planting.	Date of commencement of harvest.	Mode of harvesting.	Actual yield of cured leaf.	Yield per acre.
1	2	3	4	5	6	7	8	9	10	11	12
										Md. s. ch.	Md. s. ch.
1	Cigar-leaf-tobacco (exotic).	Sumatra (sessile)—									
		(i) Grown under shade of gunny cloth open on 4 sides.	Last year's farm-grown seed; originally American.	1/20	Tobacco in 1906-07, fallow in rains of 1907.	Cowdung 75 maunds.	4th to 7th November.	25th March ...	Basal leaves plucked separately; not cut whole.	0 10 0	5 0 0
		(ii) In the sun ...	Ditto ...	½	Ditto ...	Ditto ...	14th to 16th November.	15th March ...	Cut whole ...	2 8 0	11 0 0
		(iii) Ditto, green manured.	Ditto ...	½	Tobacco in 1906-07, cowpea ploughed in rains of 1907.	Green manured with cow-pea.	23rd October to 4th November.	26th February	Ditto ...	2 22 0	13 30 0
2	Ditto ...	Havana—									
		(i) No manure ...	Imported form America in 1906.	1/20	Tobacco in 1906-07, fallow in rains of 1907.	Nil	12th to 16th November.	27th January	Ditto ...	0 21 0	2 32 0
		(ii) Manured ...	Ditto ...	½	Ditto ...	Cowdung 75 maunds.	30th October to 12th November.	5th February	Ditto ...	0 30 0	3 30 0

Serial No.	Class of tobacco.	Variety.	Source of seed.	Area, in acres.	Rotation.	Manure, per acre.	Time of planting.	Date of commencement of harvest.	Mode of harvesting.	Actual yield of cured leaf.	Yield per acre.
1	2	3	4	5	6	7	8	9	10	11	12
										Md. s. ch.	Md. s. ch.
3	Cigar-leaf-tobacco (exotic).	Connecticut seed-leaf—									
		(*i*) No manure ...	Last years' farm-grown seed.	½	Tobacco in 1906-07, fallow in rains of 1907 (paddy seedling in a portion).	*Nil*	10th to 17th November.	28th February	Cut whole ...	2 2 0	6 8 0
		(*ii*) Manured ...	Ditto ...	½	Ditto ...	Cowdung 75 maunds.	3rd to 14th November.	26th January	Ditto ...	3 22 0	14 8 0
4	Ditto ...	Stalked Sumatra	Imported from America in 1906.	$\frac{1}{20}$	Ditto ...	$\frac{1}{20}$th acre manured with 75 maunds of cowdung per acre; rest received no manure.	30th October to 10th November.	28th January	Ditto ...	...	...
5	Exotic varieties for field study.	(*i*) Sumatra (sessile).	Farm-grown seed. Imported originally from America.	.28 acre, containing 3 lines of each variety.	Tobacco in 1906-07, fallow during rains of 1907.	*Nil*	10th to 16th November.	28th January	Cut whole	0 10 0	...
		(*ii*) Sumatra (stalked).								0 8 0	...
		(*iii*) Havana ...								0 4 0	...
		(*iv*) Connecticut seed-leaf.								0 6 0	...
		(*v*) Virginia ...								0 7 2	...
		(*vi*) Yellow prior								0 10 0	...

6	Local varieties for field study.	(f) Bhengi ...	Local ...	.06 acre, containing 3 lines of each variety.	Ditto ...	Nil	10th to 16th November.	23th January	Ditto ...	0 8 0	...
		(ii) Mana Bhengi	Ditto ...							0 9 0	...
		(iii) Naokhol ...	Ditto ...							0 8 0	...
		(iv) Sindur-Ekatua	Ditto ...							0 7 0	...
7	Turkish cigarette tobacco.	(i) Cavalla ...	Farm-grown seed : originally imported from Greece.	¼ th acre, containing 5 beds for the 5 varieties.	Ditto ...	Nil	6th November	12th January	Primed ...	0 1 0	...
		(ii) Isabeli ...								0 0 12	...
		(iii) Sari ...								0 1 8	...
		(iv) Scented leaf...								0 1 4	...
		(v) Gonitz ...								0 0 12	...

As the cigar-leaf and country tobaccos grown in 1906-1907 were still in bulk when last year's report was written, their yields could not then be quoted and are now given in the following table :—

1906-1907.

Variety.	Size of plot.	Yield per plot.	Yield per acre.
1	2	3	4
		Md. s. ch.	
Sumatra sessile ...	...	·16 Entirely destroyed by hail.	No yield.
STALKED SUMATRA—			
Under shade of thatch ...	2 acre ...	0 4 0	20 seers per acre.
Between rows of arhar	Entirely destroyed.	...	.....
In the sun	·2 acre ...	1 30 0	8 maunds 30 seers.
Ditto, green manure ...	·15 acre ...	0 22 0	6 maunds.
Havana	·4 acre ...	2 3 0	5 maunds 7 seers.
Connecticut seed-leaf ...	·3 acre ...	3 8 0	10 maunds 26 seers.
Yellow prior... ...	·3 acre ...	1 18 0	4 maunds 33 seers per acre.
Virginia	·3 acre ...	1 26 8	4 maunds 35 seers per acre.
Bhangi	$\frac{1}{10}$ acre ...	0 7 0	7 maunds per acre.
Mina Bhangi ...	$\frac{1}{10}$ acre ...	0 6 0	6 maunds per acre.
Naokhol	$\frac{1}{10}$ acre ...	0 10 0	10 maunds per acre.
Sinlur-Khatua ...	$\frac{1}{10}$ acre ...	0 7 0	7 maunds per acre.

Details of cultivation and curing.

9. The land was reduced to a fine tilth before planting and the ground between the plants kept free of weeds and in a loose friable condition by frequent interculture.

The soil of the farm having proved exceptionally rich, the manuring of the crop was restricted to a lean application of 75 maunds of cowdung per acre and some plots received no manure at all. One plot was manured with

cow-pea buried green in June, some four months before the land was planted with tobacco. The cow-pea crop had grown well and produced a dense mass of vegetation which, on being ploughed in, rotted quickly in the soil.

The American and local varieties of tobacco, all of which have large leaves, were spaced 3′×1′. They were topped high and suckered in the usual way. The Turkish varieties were treated in a very different manner. These tobaccos have smaller leaves. To restrict the development of the leaf and to make it thin and fine, the plants were set very close to one another, *viz.*, 12″×9″, and were neither topped nor suckered, following in these respects the practices of the best tobacco growers in Turkey (*see* paragraph 14 of the last annual report).

The cigarette tobaccos were harvested by "priming," that is, by plucking the leaves, one by one, as they became ripe. With the cigar-leaf tobaccos (both American and the local varieties) a different course had to be followed. In a small proportion of plants on which ripe leaves appeared early in the season, the first two to four basal leaves were plucked individually, but most plants were cut whole at the base, the stems being retained with a view to utilize the moisture they contained to check the too rapid desiccation of the leaves.

The greater portion of the cigarette tobacco was cured in the sun. The method of curing followed is described in detail in the report of the Burirhat Farm.

The American and local varieties were cured in the shade. As already stated, the house used for the purpose was an improvised structure and gave no facilities for the regulation of temperature and humidity.

The cigarette tobaccos were subjected to a very slight degree of fermenation. The cigar-leaf tobaccos were bulked and rebulked several times, and the process of sweating was not complete even at the close of the year.

Fungous and Insects Pests.

10. Several forms of disease manifested themselves in the tobacco crop. Specimens of diseased leaves were submitted to Dr. Butler, Imperial Mycologist, for identification and advice. *Erysiphe Cichoracearum*, a specie of white mildew, which had attacked shade-grown tobacco on the farm in previous years, was not noticed this year, but a new fungus disease, characterized by the appearance of black mould in the leaves, appeared on shade-gown tobacco. Dr. Butler's report on this disease has not yet been received.

Mention was made in the report of 1906-1907 of an obscure disease which attacked the Genitz variety of tobacco and which Dr. Butler thought to be a form of the "Mosaic" disease, the cause of which is uncertain. This disease appeared again in the same variety, but did not spread to other varieties growing near it.

A peculiar tobacco disease was noticed for the first time on the farm. On enquiry it was found to be a fairly common one in the raiyats' fields, and is known to them as the "kadua"(কাদুয়া) disease. The chlorophyll in the leaves gets gradually destroyed, and the leaves assume a transparent yellow colour. Dr. Butler considers this disease to be a form of the "Mosaic" disease, though its external indications are very different from those of the disease which attacked the Genitz tobacco. The Mosaic disease is regarded in other countries as probably the most destructive tobacco disease known. The "kadua" disease of Rangpur differs in that it does not kill the plant, nor does it spread rapidly. A certain amount of loss occurs in consequence of the leaves of diseased plants being prevented from attaining their proper development, but the damage is not as yet serious enough to attract more than passing notice.

Another tobacco disease noticed during the year is one caused by the attack of a fungus identified by Dr. Butler as *Cercospora Raceborskii* The leaves first become spotted; the spots gradually shrivel up and become perforated and the leaves finally get entirely dry. This disease is said to be common in India, Java, and Ceylon, but is never sufficiently destructive to need special treatment.

In a few plants, a peculiar form of white discolourment known as "albigavem," appeared. The cause of the disease is unknown. The only insect pest that is trouble was the cutworm. It caused some loss of young plants. The only curative measure adopted was hand picking which was continued daily so long as the pest remained in evidence.

Description of the tobacco experiments.

11. The experimental work done with tobacco during the year followed very nearly the same lines as in 1906-1907 and comprised :—

1. *The growing of wrapper leaf under shade.*—The shade used on this occasion was that of a thin gunn cloth, stretched over the top of the plants. A light thatch of grass had been used in previous years, but this produce

too much shade and favoured the growth of mildew, and was, therefore, given up as unsuitable. The variety of tobacco used in this experiment was sessile Sumatra [No. 1 (*i*) in the list in paragraph 8] grown from seed raised on the farm in the previous year. The crop grew well, but a black mould (not yet identified) appeared on some of the plants and rendered it necessary to harvest the crop before it was fully mature. This mould seemed different from the white mildew (*Erysiphe Cichoracearum*) which attacked shade-grown tobacco in previous years. The crop yielded at the rate of 5 maunds per acre. The extra cost of shading was at the rate of Rs. 943-12. This gunny will probably last for three years, but there is no prospect of a profit being made from tobacco grown under shade.

2. *The growing of wrapper leaf in the open.*—The same variety was tried as in experiment (1). The crop grew well and yielded a total outturn equivalent to 11 maunds 35 seers per acre, but it is not yet possible to say what proportion of this will be suitable for wrapper.

3. *The growing of leaf suitable for fillers—Havana and connecticut seed leaf* (Nos. 2 and 3 of the table in paragraph 8) were grown for this purpose. The *sessile Sumatra* tobacco, grown for wrapper leaf, also gave a considerable proportion of filler leaf. The connecticut variety appears to be the most prolific, its outturn of cured leaf being 4 times as great as that of Havana.

4. *The growing of five varieties of Turkish tobacco suitable for the manufacture of cigarettes*—A very small area ($\frac{1}{40}$th of an acre) was planted with the five Turkish varieties entered under the No. 7 in the list in paragraph 8. The largest crop was given by the Sari variety. Several experiments had been designed to test the effects of cowdung and green manuring as against no manure, but in consequence of a mistake of the Officiating Superintendent in planting the contrasted plots on widely different dates, the results were of no value.

The yields of tobacco are given in the last 2 columns of the first table in paragraph 8. So far as the present indications go, suitable leaf for wrappers as well as for fillers is expected to be obtained from the *sessile Sumatra* and *connecticut seed leaf* varieties, and *Havana* is expected to give

good filler leaf for the manufacture of dark coloured cigars. Among the country varieties, *Naokhol* approximates closely to the ideal of a good cigar-leaf tobacco, and is full of promise. The other country varieties, *Bhengi*, *Mana Bhengi*, and *Sindur-Khatua*, seem more suitable for cigarette making than for use as cigar leaf. The Turkish tobaccos have been greatly modified as regards the size of leaves by the method of cultivation pursued during the year. The objects we have in mind were to reduce the size of the leaf by a system of close planting and to make it thin and fine by omitting the usual operations of tapping and suckering, these being the ideals aimed at by the Turkish cultivators. These aims have been to a great extent realized. The size of the leaves has been greatly reduced and their texture considerably improved. The Turkish method of sun-curing was followed with the greater portion of the crop. A good yellow colour has been obtained, though the brightness of the genuine Turkish leaf is lacking. The leaf appears to have a mild pleasant aroma, but less pronounced than that of Turkish tobacco.

Examination of varieties.

12. Some of the best known varieties of Rangpur local tobacco (No. 6 in the list in paragraph 8) were grown side by side with the exotic varieties of cigar tobacco (No. 5 in the list), and the Farm Superintendent made careful notes on the characters of each in the field and also after curing. His observations are summarised in the appendix.

Raising self-fertilized seed under glass.

13. An attempt was made in the previous year (1906-1907) to raise self-fertilized seed of certain varieties of tobacco by enclosing a number of flower-heads in paper bags following the practice which has come into vogue in the United States. The object was to protect the flowers from being fertilized by pollen from other plants and by ensuring self-fertilization in this way, to raise seed which would produce plants possessing the character of the parent plant. The paper bags proved too flimsy to stand the heavy dews of the winter months and the stormy weather which frequently occurs during the spring. Instead of remaining inflated, they become flabby and pressed closely on the flower heads inside. A small quantity of seed was obtained, but on testing it was found to be of very weak germinating power, and was, therefore,

rejected as useless. The experiment was repeated during the year under report, but this time paper bags were replaced by glass frames which proved very suitable for the purpose. These frames were 12″×9″×9″ and gave enough room for the flowerhead to open and develop. The top and four sides of the frame were of glass, and the bottom was covered loosely with a muslin bag through which the flower-head was passed and the bottom end of which was wrapped round its stalk. Complete protection from extraneous pollen was secured in this way, while the glass in the top and the sides allowed the enclosed flower head to enjoy the light of the sun. The frame was tied to a couple of stout sticks driven into the ground and thus protected from being blown down by the wind. The experiment was made with three varieties of tobacco, *viz.*, *Sessile Sumatra*, *Havana*, and *Cavalla*. To begin with, a careful plant-to-plant examination was made in the field with reference to such characters as the shape, size and thickness of the leaves, the character of the veins, the angle which the veins made with the midrib, the length of the inter-nodes, etc., and only such plants as appeared to possess the desirable characters in the greatest degree were selected for the breeding experiment. In all nine plants of *Sessile Sumatra*, and ten each of *Havana* and *Cavalla* were selected in this way. These plants were left untopped, and the main flower head of each was protected from cross-fertilization by a glass frame in the manner described above.

The experiment proved very successful with the *Sessile Sumatra* and *Havana* plants. They have produced a quantity of good, well-matured seed which has been saved for sowing in the ensuing season. The seed obtained from each plant has been kept apart, and a record has been kept of the character of each parent plant in order to compare these with the characters of its progeny. The *Cavalla* plants failed to produce any seed. It is difficult to account for this failure. The *Cavalla* tobacco was planted very thickly (12″×9″), and the flower heads were particularly small. These circumstances would, however, fail to account for the non-formation of seed in the protected plants, as plants that were allowed to produce seed in the open air produced an abundance of seed

Valuation of farm tobacco.

14. Samples of the following types of tobacco from the crop of 1905-1906 were submitted for valuation to a Tobacco Expert in France, and to Messrs. Spencer & Co., of Dindigal, and Messrs. Oakes & Co., of Madras:—

Cigar-leaf.

1. Sumatra grown in the shade.
2. Sumatra grown in the sun.
3. Ditto, ditto.

Cigaratte-tobacco.

4. Cavalla.
5. Scented leaf.
6. Isabeli.

The French Expert was of opinion that the *Sumatra* tobacco could be used as the inter-leaf of cigars and valued it at $3\frac{3}{4}$ *d.* to $5\frac{1}{2}$ *d.* per lb. (Rs. 18-12 to Rs. 27-8 per maund of 80 lbs.) He valued the *Cavalla* and *Isabeli* tobacco at $2\frac{1}{4}$ to $3\frac{3}{4}$ *d.* per lb. (Rs. 11-4 to Rs. 18-12 per maund). He put his quotations purposely low as he said that tobacco without an established reputation in the market would always sell cheap. Messrs. Spencer & Co. thought that the shade-grown *Sumatra* did not turn well and was therefore, of no value, but they expressed a very favourable opinion of the two samples of *Sumatra* grown in the sun. The report on these two samples was as follows:—

No. 2.—Fair burning, aroma good, not much to choose between this and No. 3. Fine long leaf.

No. 3.—Burns well, aroma excellent, and is the best of the lot. Fine long leaf.

They quoted to be 8 annas per lb. (Rs. 30 to Rs. 40 per maund) for these two samples. The three samples of cigarette tobacco were repotred on by the same firm in the following terms:—

No. 4.—*Cavalla.*—Leaf rther leathery, but burns well, aroma fair, nothing like No. 5.

No. 5.—*Scented leaf.*—Leaf thick, aroma good and more of the nature of *Havana*, burning good.

No. 6.—*Isabeli.*—Burns well, leaves small, compares favourably with No. 5.

Value.—Nos. 4, 5 and 6 worth between 3 and 4 annas per lb. (Rs. 15 to Rs. 20 per maund.)

Messrs. Oakes & Co., on the other hand, considered that No. 1 (shade-grown *Sumatra*) was the only sample of any value, all the rest, in their opinion, being practically worthless.

Below are given the result of chemical analysis of some cigarette tobaccos from the Rangpur Farm made in November 1907 by the Government Chemist of the Tobacco Monopoly Bureau, Tokyo, Japan :—

—	Moisture.	Ordinary matter.	Pure ash.	Soluble alkalis.	Total nitrogen.	Nicotine.	Remarks.
1	2	3	4	5	6	7	8
1. Scented leaf	4·16	75·84	19·38	4·231	1·905	0·655	Good, for cigarette, 1st.
2. Sari	5·53	74·85	18·69	5·156	1·883	0·604	Mild and aromatic, fit for cigarettes, 2nd.
3. Cavalla	4·22	71·32	20·55	4·363	1·993	0·514	Pretty mild for cigarettes, 3rd.

The above analyses were received through the courtesy of a Bengali student now studying cigarette-making in Japan.

Samples of tobacco from the crop of 1906-1907 were sent to England for valuation. The reports on these samples have just been received.

A list of the samples sent to England is given below :—

Serial No.	Variety.	Grade.	Remarks.
1	2	3	4
1	Connecticut seed leaf ...	Big size	Cigar-leaf.
2	Ditto ...	Small size	Ditto.
3	Yellow prior ...	Big size	Ditto.
4	Ditto ...	Small size	Ditto.
5	Havana	One grade	Ditto.
6	Sumatra (stalked) ...	Big size	Ditto.
7	Ditto	Small size	Ditto.
8	Virginia	Big size	Ditto.
9	Ditto	Small size	Ditto.
10	Cavalla	One grade	Cigarette tobacco.
11	Scented leaf ...	Ditto	Ditto.
12	Sari	Ditto	Ditto.
13	Isaboli	Ditto	Ditto.
14	Genitz	Ditto	Ditto.
15	Bhengi	Ditto	Cigar tobacco (local)
16	Sindur khatua ...	Ditto	Ditto.
17	Naokhol	Ditto	Ditto.
18	Mana Bhengi ...	Ditto	Ditto.

Reports have been received from two London tobacco firms and one Edinburgh tobacco firm.

All these firms express very unfavourable opinions of the tobaccos.

One of the London firms commences by stating that their opinion is based entirely on the use that might be made of the tobaccos by their Company and not from the point of view of the tobacco trade in general.

The following is the substance of their remarks on the various varieties :—

"Nos. 1, 2 and 3 might be blended in shags. It would be advisable to have 2 or 3 inches butted off the stalks.

No. 4 might be used for the above purpose without butting.

Nos. 6 and 7 might be blended with other tobaccos for cigars, but the colour and texture is not regular enough for outer wrappers.

No. 9 should prove a useful tobacco if it could be delivered in this country (England) at say 4 *d.* a pound.

Nos. 10, 11, 12, 13 and 14 are too dark for the manufacture of cigarettes. Nos. 10 and 14 might be used for manufactured tobacco.

No. 17 is too strong for wrapper, and burns with a dark ash. Small quantities might be used for blending with the filler.

Nos. 5, 8, 15, 16 and 18 we could make no use of."

They suggest that to form a correct opinion of the tobacco, samples of not less than one bale of each variety should be sent to them.

The other London firm emphasises the fact that all the foreign varieties of tobacco have "lost all trace of their origin."

They consider that the Turkish tobaccos have lost their character and are therefore useless for the manufacture of cigarettes.

They state further that "Native Indian tobacco has always rather an earthy taste, which is already apparent to a very pronounced degree in the new seeds, especially in the cigar tobaccos."

Finally, they state that the worst feature of all the tobaccos is their musty flavour.

The Edinburgh firm think that the tobaccos would have no value at all in the English market.

They do not consider them *worth* paying duty on compared with the tobacco they can get in the market at present.

They express the opinion that the inferior quality is not due so much to defect in curing as to unfavourable soil or climate.

The unfavourable reports given above were not altogether unexpected.

In the first place the crop of 1906-07 was very badly damaged by a severe hailstorm in March 1906.

No proper curing or fermentation houses were available and the tobacco had to be cured and fermented in temporary sheds where there was no chance of regulating the temperature and humidity.

The musty flavour of the tobacco described by the Edinburgh Farm was probably due to the tobaccos becoming mouldy in transport.

The tobacco crop of 1907-08 has been grown under more favourable climatic conditions than the crop of the preceding year, and is being cured and fermented in properly-constructed permanent houses.

We therefore expect the quality of the tobacco to be a great improvement on that sent to England for valuation last year.

This year, when the curing, fermentation, and sorting is finished, we intend to forward samples of our 1907-08 crop to London for valuation and expect to receive a much more favourable report.

The Superintendent of the India Trade Enquiry Office, London, has suggested that we should send him, for valuation one of our best grades of leaf carefully packed in an airtigh case with the object of ascertaining whether the mustiness was due to the samples not being properly packed, or whether it was due to defect in curing. When the tobaccos have been sorted we shall send him two small samples, one of our best cigar-leaf tobacco and the other of our best cigarette tobacco, packed as directed.

Manufacture of cigars and cigarettes.

15. Since August 1905 a professional cigar roller has been employed to make cigars and cigarettes from the tobacco grown on the farm for the purpose of testing the quality of the various varieties.

The manufacture of cigarettes has been discontinued, as the small hand machine does not work well and the cigar roller is not an expert cigarette maker.

During the year, 29,266 cigars were made in four brands, *viz.* :—

			Rs.	a.	
1. Torpedo No. 1,	4½ inches long,	sold at	2	8	per 100
2. Torpedo No. 2,	4 „	„	2	0	„
3. Torpedo No. 3,	3½ „	„	1	8	„
4. Manilla shaped,	3½ „	„	0	12	„

The amount realised from sales of cigars during the year was Rs. 166. A certain number were given away as samples and some still remain unsold. The cigars are packed in boxes bearing labels giving the brand size and shape of the cheroots, the varieties of tobaccos used for wrapper and filler and season in which the tobaccos were grown. We have received many favourable reports of our cigars. They burn well and possess a mild though not a very pronounced flavour.

Their ash appears to be rather darker than that of the best brands of Indian cigars.

Other experimental crops.

16. *Ginger.*—Since 1905-06 four varieties of ginger have been grown annually.

The following table gives the yield of each variety harvested in 1908 :—

Variety.	Size of plot.	Green ginger.	
		Yield per plot.	Yield per acre.
1	2	3	4
	Acre.	Mds. srs.	Mds. srs.
Cochin	$\frac{1}{10}$	12 13	123 10
Calicut	$\frac{1}{10}$	12 33	123 10
Jamaica	$\frac{3}{100}$	4 2	135 0
Country (local) ...	$\frac{1}{20}$	4 3	163

All the varieties were attacked by a fungus disease—*Pythium Gracile*—which is very prevalent in the district.

As a preventive against the disease precautions were taken when harvesting the crop to remove all the rhizomes from the sil, and these which showed any signs of the disease were destroyed. The new crop was planted as far away from the site of the old crop as possible, and as far as could be ascertained by the eye, only healthy seed was used for planting.

A fresh consignment of Jamaica ginger has been received this year from Jamaica through the Superintendent, Royal Botanical Gardens, Calcutta, and this has been planted on a small plot.

Two maunds of each of the varieties grown were cured according to the instructions given in a paper by Mr. C. A. Burrit in the Journal of the Jamaica Agricultural Society for July 1903.

After harvesting the rhizomes they were freed from dirt and small roots, carefully skinned with a knife and the corners rounded off.

They were then washed and laid out on mats in the sun to dry. At midday the pieces were turned over so that the underside was exposed to the sun.

At night the ginger was made into a heap and left in the open air.

This treatment of spreading out the gingers during the day and heaping it up at night was continued for a week. By this time it was quite dry.

It was then soaked for half an hour in a solution of 2 ounces of lime juice in a gallon of water and afterwards again spread out on mats to dry.

This method was found to be very tedious and expensive as the coolies employed for scraping the rhizomes were new to the work and could only do it very slowly.

The weights of cured ginger obtained by this method from two maunds of green ginger of each of the four varieties are given below—

Variety.	Weight of cured ginger. lbs. s.
Cochin	12½
Calicut	18
Jamaica	13
Country	13½

Samples of each of the varieties of ginger cured in the manner described above were sent to the India Trade Enquiry Office through the Director General of Commercial Intelligence, Calcutta.

The samples were submitted by the Superintendent India Trade Enquiry Office, to two London firms; one a firm of spice brokers and the other a wholesale spice merchant.

The opinions of the two firms differed widely. The report of the firm of brokers was decidedly encouraging. Their valuation is given in the following table in the first column, and the current prices of Jamaica, Cochin, and Calicut gingers, on the London market as quoted by them are given in the second column for comparison.

Variety.	Valuation.	Price on London market of gingers sold under these names.
1. Jamaica ...	40 *s.* per cwt.	65 *s.* per cwt.
2. Cochin ...	33 *s.* „ ...	35 *s.* per cwt.
3. Calicut ...	„ ...	37 *s.* per cwt.
4. Country ...	30 to 32 *s.* ...	No quotations given.

The Jamaica ginger is rather disappointing, but the Cochin and Calicut varieties are valued only slightly lower than the current quotations for these varieties.

The report concludes with the statement that the Jamaica, Cochin, and Calicut gingers do not fully bear the character of these grades, respectively, but they express the opinion that the gingers may be improved by careful cultivation.

The firm of wholesale spice merchants reported unfavourably on all the samples.

They were of the opinion that all the samples were of one grade, *viz.*, Calicut ginger, and that there would be no sale for it in London owing to its inferior quality. They valued it at 24 *s.* per cwt.

17. *Potato.*—Four varieties of potatoes, *viz.*, Naini Tal, Darjeeling, Flowerhall and Sil Bilaiti (local), were grown on small plots of $\frac{1}{10}$th of an acre. They were all manured with 150 maunds of cowdung per acre. Each plot was divided into two equal parts. The one part was sprayed twice with Bordeaux mixture while the other part was untreated. The cost of spraying was 13 annas per plot or Rs. 16-4 per acre.

The following table gives the yield of each variety on the sprayed and unsprayed portions of the plots. The Flowerhall variety is omitted from the table, as the crop was very badly injured by fowls and goats :—

Variety.	Size of plot.	Sprayed half of plot.		Unsprayed half of plot.		Remarks.
		Yield per plot.	Yield per acre.	Yield per plot.	Yield per acre.	
1	2	3	4	5	6	7
		Mds. srs.	Mds.	Mds. srs.	Mds.	
Sil Bilaiti ...	$\frac{1}{10}$ acre	6 0	120	5 15	107½	This variety was also somewhat damaged by animals.
Darjeeling ...	Do. ...	9 10	185	8 0	160	
Naini Tal ...	Do. ...	6 0	120	7 0	140	

The Darjeeling variety gave the best yield, and the sprayed half of the plot gave an increase of 25 maunds per acre on the unsprayed portion. With the Naini Tal variety the reverse was the case. This variety was attacked by the well known potato disease *Phytophora infestans* and also by the "Brown rot" of potatoes. More diseased tubers were found in the sprayed portion of the plot than in the unsprayed portion. and that accounts for the decrease in yield.

The result is remarkable, as, since the Naini Tal variety was badly diseased and the other varieties were practically free from disease, you would expect the spraying to have the greatest effect on the Naini Tal variety.

However, it should be explained that the unsprayed portions of the plots ripened and were harvested three weeks earlier than the sprayed portions; so the explanation may possibly be that the "Brown rot" had more time to develop in the sprayed portion of the plot, as the tubers were three weeks longer in the ground.

18. *Oats.*—Oats have been grown on the farm for the last three years, but the crop is not commonly grown by cultivators in the district. Altogether two acres were grown without manure. Half an acre was cut green and the fodder fed to the work cattle, and the remaining 1½ acres was harvested when ripe and the grain threshed out by treading with bullocks.

The total outturn of grain from 1½ acres was 26 maunds, which works out at 17⅓ maunds per acre, and is a very satisfactory result.

Non-experimental crops.

19. These were:—

Winter rice	...	...	...	9·44 acres.
Jowar	...	...	...	0·54 „
Maize	...	...	...	0·14 „

The last two crops were fed green to cattle. The yield per acre of *jowar* amounted to 202 maunds per acre and that of maize to 225 maunds per acre.

The winter rice gave 13 maunds 6 seers of unhusked paddy per acre. The low yield was probably due to the crop being submerged for some time in August owing to heavy falls of rain, and also to the fact that it suffered from lack of water later on after the close of the rainy season. The bulk of the crop consisted of a medium coarse variety locally known as *Joshoa*. It yielded 17½ maunds per acre. A fine variety named *Kataribhog* only gave 11½ maunds per acre.

New implements.

20. The Planet Junior hand-hoe did good work in cultivating between the rows of maize, tobacco and gingers.

The Hindustan plough is still being used, but seems to do no better work than a plough made after the local pattern only slightly bigger, which is also used on the farm.

A knapsack sprayer was used for spraying the potatoes with Bordeax mixture.

Seed distribution.

21. The following quantities of seed were supplied by the farm during the year :—

Tobacco seed—

Exotic varieties	...	...	15¾ oz.
Country ...	...	...	7¼ oz.
Potatoes (local)	...	...	30 seers.
Sugar cane (Vandamuki, local)		...	200 whole canes.
Jamaica seed ginger	...	...	4½ seers.

Receipts and expenditure.

22. The receipts for the period under report amounted to Rs. 984-11-3 and the expenditure to Rs. 13,187-2-1. The expenditure includes a sum of Rs. 6,837 for capital charges and Rs. 3,158 for pay and travelling allowance of the establishment.

The capital charges were incurred on account of the new farm at Burirhat and consist of the cost of sheds and clearing, levelling and road-making work.

Inspection.

23. The Hon'ble Mr. P. G. Melitus visited the farm in February 1908. The Collector of Rangpur paid frequent visits to the farm.

The Director of Agriculture inspected the farm once during the year, the Assistant Director 3 times, and the present Officiating Assistant Director once.

Establishment.

24. The establishment of the farm consists of a Superintendent on Rs. 100—10—200, a fieldman clerk on Rs. 25—1-8—40 and a peon on Rs. 8 per month.

A cigar roller is also employed on the pay of Rs. 30 per month.

APPENDIX.

The varieties of Cigar Tobacco grown on the Rangpur Farm in 1907-1908, their characters in the field and after curing.

Variety	Green leaf.				Growth, heavy or light; number of leaves kept.	Cured leaf.				Remarks
	Length of leaves.	Width of leaves.	Length of stalk, if any.	Shape, appearance and disposition of leaves.		Thickness.	Texture.	Gum.	Colour and texture of leaf.	
1	2	3	4	5	6	7	8	9	10	11
Cigarleaf Tobacco.										
1. Sumatra (seeds)	20" to 24"	8" to 12"	Sessile ...	Elliptic oblong, amphitroid, leaves closely set on stem, semi-erect, giving green plants a somewhat appressed.	Very heavy, 12 to 20 leaves.	Thin ...	Veins are quality fine, in a portion of leaves above the ground, but here rank, the veins appear coarse in the lower portions of the leaves; the veins are of about the same colour as the rest of the leaf.	Normal ...	Thin, silky and strong, most leaves suitable for wrappers, it is decidedly the best of all.	Second generation from seed imported from Sumatra. Some leaves when cured were of a good golden yellow colour and appeared to be suitable for cigar-making.
2. Sumatra (seeds) grown in stable	21" to 25"	8½" to 12½"	Thick ...	Thick thick ...	Thick ...	Thick ...	Veins are fine ...	Less than normal.	Very thin, silky and strong; fit for wrappers.	A good portion of the leaves did not colour well owing probably to mould.
3. Sumatra (seeds)	17" to 20"	8" to 10"	About 2 in. size, long, thick.	Broadly elliptical, oval with pointed tip, petiole leaving (semi-erect); long internodes giving the plant a lanky appearance.	Light, 12 to 15 leaves.	Thick ...	Coarse ...	More than normal.	Pale yellow colour, partly spotted, may do for fillers.	This is a fresh type very inferior to the whole; will be discarded from future trials.
4. Havana ...	12½" to 18½"	5½" to 8½"	Sessile ...	Oblong, gently tolse or long or broad, semi-erect; leaf clasping here pressed close to the stem; internodes fairly long.	Light, 12 to 15 leaves.	Thin ...	Fine veins, not prominent at the margins of the leaves.	Normal ...	Dull yellow colour, few spots, will do well for fillers.	May do well for dark-coloured cigars.
5. Cigarleaf seed leaf.	22" to 24"	6" to 10"	Thick ...	Lanceolate, narrow with long pointed tip, semi-erect; short internodes like No. 1.	Light, 10 to 12 leaves.	Medium thick.	Medium	Thin ...	Good colour and texture, next to quality to No. 1 in point of texture, suitable for making wrappers and fillers.	Some of the leaves cured as good golden yellow colour and appeared to be suitable for cigarettes.
6. Yellow grass ...	16" to 20"	6" to 10"	Thick ...	Elongated, narrow with long pointed tip, semi-erect; internodes of medium length.	Thick ...	Coarse ...	Coarse	Slow-growing	Dull coloured, may do for fillers.	
7. Virginia ...	18" to 20"	8" to 10"	Thick ...	Thick thick ...	Thick ...	Thick ...	Coarser than No. 6 ...	Thick ...	Thick thin.	
Country Tobacco.										
8. Bhangi ...	16" to 20"	10" to 12"	About 3 ins. long, winged on the base.	Cordate with pointed tip, semi-erect; internodes of medium length.	Heavy, 14 to 16 leaves.	Thick ...	Medium fine	Less than normal.	Dull mahogany colour, thin but wearing in texture.	
9. Desi Bhangi ...	16" to 20"	12" to 15"	About 3 ins. long, winged on the base.	Cordate, with the tongue well developed (See Diagram No. 2); semi-erect, internodes longer than in No. 8.	Heavy, 12 to 14 leaves.	Thick ...	Medium coarse ...	Thick ...	Thick thin.	
10. Nankhal ...	20" to 22"	12" to 14"	About 3 ins. long, winged on the base.	Elongated, narrow, tapering towards the apex, partly erect, clasping leaf long internodes.	Heavy, 12 to 14 leaves.	Thick ...	Thick ...	Normal ...	Medium coarse No. 1 in colour, not to close, some leaves could be used as wrappers and the rest as fillers.	
11. Medium Khetta ...	18" to 20"	8" to 11"	About 3 ins. long, winged at the base.	Oblong, with pointed tip, semi-erect, long internodes.	Medium, 12 to 14 leaves.	Thin ...	Fine	Less than normal.	Copper coloured; may do for cigarettes.	Some of the leaves of all three cropping varieties have cured a good golden colour and may be suitable for making cigarettes.
Cigarette Tobacco.										
12. Cavalla ...	8" to 12"	2½" to 3½"	Sessile ...	Oval with rounded tip, leaves smallest of all the varieties grown, semi-erect, long internodes.	Very light, 20 to 25 leaves.	Thin ...	Fine; midrib nearly at right angles to midrib.	Normal ...	Light yellow colour; no spots, good texture, best of the 3 Turkish varieties for making cigarettes.	
13. Samsun leaf ...	8" to 10"	2½" to 3"	About 2 ins. long, thick.	Oblong with pointed tip; semi-erect, like a number of cigarette leaves.	Heavy, 15 to 20 leaves.	Thin ...	Fine	Thin ...	Light yellow colour; next in point of quality to Cavalla.	Compact inflorescence.
14. Izmirli ...	6" to 10"	2" to 3"	Sessile ...	Elongated, narrow with pointed tip, semi-erect.	Light, 15 to 20 leaves.	Thin ...	Medium thin	Thin ...	Dull yellow colour ...	Thin thin.
15. Burt ...	6" to 10"	2½" to 3"	Thin ...	Thin thin ...	Fairly heavy, 15 to 18 leaves.	Thin ...	Thin	Thin ...	Thin	Leaves larger than those of No. 14.
16. Orfali ...	5" to 10"	2½" to 3"	About ½ in. long, thick.	Oblong with pointed tip, semi-erect.	Light, 25 to 30 leaves.	Thin ...	Thin	Less than normal.	Pale yellow colour, inferior to that of the other 4 varieties.	This year also the crop was attacked by the "spotty" disease of tobacco, the cause of which is uncertain; a portion of the leaves in Nos. 14, 15 and 16 coloured green in curing.

REPORT ON THE BURIRHAT AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1908.

ANNUAL REPORT ON THE BURIRHAT AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1908.

1. It has been already mentioned in the report on the Rangpur Farm that, as the site of the farm at Rangpur is outside the true tobacco-growing belt of the district, it was decided to remove the tobacco experimental station to a new site at Burirhat, some 5 miles north of Rangpur town. For this purpose about 52 acres of land were acquired at Burirhat last year. The greater portion was grazing land, but a considerable amount of jungle had to be cleared.

1. History and description of the farm.

2. The soil is a typical sandy loam of the tobacco-growing belt. The sub-soil at a depth of from 1½ to 2 feet is almost pure sand. No analyses of the soil have yet been made.

Soil.

3. A tobacco-curing house, a fermentation house, an office and a godown have recently been built. The curing and fermentation houses are specially constructed for the regulation of temperature and humidity as far as possible.

Equipment.

The godown is of corrugated iron with a brick floor. A small room for the accommodation of inspecting officers is attached to the office. Quarters for the Farm Superintendent and fieldman clerk are sanctioned, but building operations have not yet been commenced.

The cattle will be housed in a temporary structure pending the construction of a permanent building.

The farm is at present unenclosed, but it is intended shortly to erect wire fencing round it. A public right-of-way divides the area into two blocks, so it is proposed to fence each block separately.

4. During the year under report the work mainly consisted of jungle clearing, making of roads and levelling where necessary. Part of the farm was also laid out in plots of multiples of a *bigha* and the land was broken up with *kodalis*.

Work done during the year.

The only crop grown on the farm was tobacco:—

Cigarette tobacco	...	...	·5 acre.
Sumatra for cigars	...	...	·05 „
Total	...	...	0·55 acres.

The following table gives the different varieties of tobacco grown and some important details of cultivation.

In column 4, the original source of seed is given. The seeds sown here were collected from plants which grew on the Rangpur Farm during the previous season. So they are really one year acclimatized.

Serial No.	Class of tobacco.	Variety.	Original source of seed.	Area, in acres.	Previous crop.	Manures applied per acre.	Time of planting.	Date of commencement of harvest.	Mode of harvesting.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
1	Cigar-leaf tobacco	Sumatra Sessile	America...	·05	Fallow	Nil ...	21st—22nd October.	13th March 1908.	Cut whole	The crop was much injured by a black mould which has not yet been identified.
2	Cigarette tobacco	(i) Cavalla ...	Green ...	·25	Ditto	Ditto	22nd October.	7th January 1908.	Primed.	
		(ii) Scented leaf	Ditto ...	·25	Ditto	Ditto	Ditto ...	7th January 1908.	Ditto.	

Description of the tobacco experiments.

5. There were two experiments with tobacco :—

(1) To grow wrapper leaf under shade.

(2) To grow small leaved Turkish tobacco for cigarettes, by following the Turkish method of cultivation.

In the first experiment Sumatra (Sessile) tobacco was grown on $\frac{1}{20}$ acre.

A bamboo framework, about 8 feet high, was erected over the plot, and the roof and sides covered with gunny cloth.

The gunny cloth was found to give much better results than the straw thatch which was used for giving shade last year. The crop grew much better and more evenly under the gunny cloth than it did under the thatch.

In the second experiment an endeavour was made to reduce the size of the leaf of Turkish tobacco by close planting.

Last year some samples of high class Turkish cigarette tobacco were sent to us through the courtesy of the British Consul at Constantinople.

The most striking features of these tobaccos were their bright golden colour and the extremely small size of the leaves, the largest of which were not more than $4'' \times 3''$.

Two varieties of Turkish tobacco, *viz.*, Cavalla and scented leaf, were grown each on quarter of an acre of land.

The land, which was originally grazing ground, was broken up in the preceding rains and worked thoroughly until it was in a state of good tilth. It was then laid out in beds with paths two feet wide between them, so that all the field operations could be carried on without the necessity of treading on the beds.

One-eighth of an acre of each of the two varieties was planted $6'' \times 9''$ apart, whilst the remaining eighth of an acre in each case was planted $9'' \times 12''$ apart.

No manure was applied to either variety, and the plants were neither topped nor suckered.

The leaves were harvested separately as they matured.

The experiment with Turkish tobacco was certainly successful in keeping down the size of the leaves, but they were still somewhat bigger than the miniature specimens received from Turkey. As was expected, the closer system of planting gave a slightly smaller leaf. In the production of the bright golden colour we were not so successful.

The colour of the cured leaves was duller and a good deal darker than that of the leaves grown in Turkey. This was no doubt due to the fact that the weather conditions at Rangpur rendered it impossible to finish curing the leaves in the sun, which method is followed in Turkey.

Method of curing Turkish tobacco.

6. A small quantity of the Turkish tobacco was cured inside in the ordinary way, but with the greater portion of the crop an attempt was made to cure it in the sun in the manner described below.

As the leaves were gathered they were taken to the curing shed, sorted into 3 grades according to the degree of yellowness of the leaf, and then made up into bundles of from 20 to 30 leaves, each grade being kept separate. The bundles were then piled in layers on the ground, every alternate layer being placed crosswise. The tobacco remained in this way for two days so that the leaves might become wilted. The leaves were then threaded together and suspended on poles inside the house for 24 hours. The poles with the tobacco were then taken outside and exposed to the sun. Each night they were protected from the dew by a roof of bamboo *chatai*.

Unfortunately, about this time, the weather became cloudy and misty and it was found impossible to finish curing the tobacco outside. So it was removed to the curing house and the curing was finished inside.

The above method of curing Turkish cigarette tobacco is recommended in a French book on tobacco written by M. Tozoni, and is said to be widely practised in Turkey.

Insect and fungus pests

7. The cigar-leaf tobacco was found to be attacked by mildew (*Erysiphe Cichraccarum*). This mildew has been noticed for several years on the tobacco at the Rangpur Farm.

Another mildew, dark in colour, was found to have done a great deal of damage. Specimens of this disease

were forwarded to the Imperial Mycologist for examination, but his report has not yet been received.

The only insects which did any damage to the crop were cutworms.

These were handpicked daily until the young plants were big enough to withstand the attacks.

Yields of tobacco.

8. The yields of the cigar and cigarette tobacco are given below :—

Variety.	Size of plot.	Yield per plot.	Yield per acre.
1	2	3	4
	Acre.	Md. s.	Md. s.
1. Sumatra—			
(Cigar-leaf tobacco grown under shade).	$\frac{1}{10}$	0 8	4 0
Turkish cigarette tobaccos—			
1. Cayalla	$\frac{1}{4}$	1 37	7 28
2. Scented leaf ...	$\frac{1}{4}$	2 7	8 28

Miscellaneous.

9. The work of the farm was supervised by the Superintendent of the Rangpur Farm. No separate establishment was maintained at Burirhat, and all expenditure was incurred under the heading of the Rangpur Farm.

It is intended to remove the whole establishment of the Rangpur Farm to the new farm at Burirhat from 1st August 1908.

ANNUAL REPORT ON THE RAJSHAHI AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1908.

Introduction.

The present report, though relating to the year commencing with 1st July 1907 and ending with the 30th June 1908, deals with the bhadoi crops grown in the rains of 1907, which were sown in the last quarter of the preceding year (April to June 1907) and with the cold weather crops of 1907-1908. The bhadoi crops on the ground at the end of June 1908 are not dealt with in this report.

History.

2. The Rajshahi Farm was created in November 1904. The Farm is situated very close to Rampur Boalia town, the headquarters of the Rajshahi district. It covers an area of 63 acres, out of which about 50 acres is available for cultivation, the rest being occupied by sites for houses, roads, drains and a small jheel at the north-western corner of the Farm. The land, though it has been in the possession of Government ever since the Farm was started, was till recently the property of the Rajshahi Association. Proceedings for the acquisition of the land under the Land Acquisition Act are in progress.

Description of soil.

3. About one-half of the area of the Farm is low land with a dark clay soil, and is well suited for the cultivation of winter rice and jute. The rest of the area is high land with a lighter soil, and suited for jute and the usual dry crops of the country. The land has been long under cultivation, and a small *basti* stood in the south-east corner of the Farm at the time the land was taken up for the Farm.

4. Seven samples of soil taken from different parts of the Farm were analysed in 1907 by Dr. Leather, Imperial

Agricultural Chemist, whose report on the composition of the samples is reproduced below :—

Average sample of all the seven —

Insoluble silicates and sand	77·90
Ferric oxide	4·56
Alumina	6·15
Lime	3·29
Magnesia	1·37
Potash	·65
Soda	·21
Phosphoric acid	·11
Sulphuric acid	·03
Carbonic acid	2·34
Organic matter and combined matter ...	3·39
Total	100·00

—	196-07. Plot No. 3.	197-07. Plot No. 37.	198-07. Plot No. 61.	199-07. Plot No. 83	200-07. Plot No. 110.	201-07. Plot No. 116.	202-07. Plot No. 120.
1	2	3	4	5	6	7	8
Organic carbon	·616	·533	·844	·806	·734	·503	·414
„ nitrogen ...	·054	·093	·085	·089	·081	·059	·043
Calcium carbonate ...	5·400	2·910	3·590	6·360	4·600	6·049	6·322
Total phosphoric acid ...	·085	·069	·051	·146	·109	·042	·106
Available phosphoric acid ...	·0034	·011	·003	·059	·035	·003	·003
Available potash ...	·010	·009	·004	·011	·001	·001	·001

Excepting plot No. 83, these soils are characterised by a difficiency of phosphates and potash; plot No. 83, is better off, more especially in the matter of phosphate. The amount of organic matter is low, but not lower than the Indian alluvial soil generally. There is abundance of carbonate of lime.

Division into plots.

5. The Farm which is in the shape of an oblong, is divided by two main roads into four rectangular blocks, and is surrounded by another road running along its boundaries. The four blocks are divided into plots of regular size. Most of the plots are $\frac{1}{8}$th of an acre each, and a few are $1\frac{1}{8}$th acre each. Much levelling work had to be done in previous years and some also during the year under report, to bring the surface of each plot to a uniform level.

Drainage.

6. The Farm is served by a large number of open drains, but owing to the absence of a proper outlet, a considerable area in the northern part of the Farm was till lately subject to water-logging during the rainy season. This defect arose to a great extent from a large drain which had been constructed many years ago by the District Board, having been allowed to silt up. On the matter being pressed on the attention of the Chairman of the District Board, the drain has recently been re-excavated and it is hoped the drainage of the Farm will be greatly benefitted thereby.

Fencing.

7. The farm is enclosed with a wire fence, but unfortunately it is not sufficiently strong to keep out cattle, and the wires being placed too wide apart afford no protection whatever against goats. The southern boundary of the Farm, which is most exposed to cattle trespass, was planted during the year with a border of *Duranta* which will soon form a strong hedge. It is proposed to gradually extend the hedge all round the Farm. The Farm is also subject to the depredations of wild pigs. Petty thefts of agricultural produce are not uncommon and it is difficult to devise means of preventing them.

Buildings.

8. The construction of Farm buildings was delayed for over three years owing to Government not having a legal title to the land. A godown, 50′×20′, is in course of construction at an estimated cost of Rs. 2,600. Estimate for quarters for the Farm staff and a pukka wall have been prepared, and this construction has been entrusted to the Public Works Department. A pukka cattle shed and an office building will also have to be built.

Character of the season.

9. The following statement exhibits the rainfall of the season under report, side by side with the normal rainfall.

Month.	Actual.		Normal.	
	Rainfall, inches.	Number of rainy days.	Rainfall, inches.	Number of rainy days.
1	2	3	4	5
1907.				
April	3·06	5	1·81	2·9
May	4·43	6	5·56	7·7
June	9·24	12	10·81	12·6
July	7·46	14	11·45	15·1
August	4·32	11	10·75	14·7
September	3·50	10	10·10	12·4
October	0·47	2	4·46	4·9
November	...	...	0·31	0·6
December	0·41	3	0·06	0·2
1908.				
January	0·67	1	0·34	0·8
February	0·94	2	0·84	1·3
March	0·01	1	1·15	1·6
Total	34·51	67	57·94	74·8

The total rainfall was greatly in defect of the normal, and it was badly distributed. The rainfall was particularly short during the season for transplanting winter rice (middle of July to end of September), when the fields should be full of water, and caused a deplorable result. The rice fields on the Farm remained high and dry and could not be transplanted. The *Ganges* too was very low and flood water which occasionally proves helpful in planting rice was not available. The consequence was that all experiments with winter rice had to be abandoned for the year.

The spring rains were fairly good and well distributed.

There was a prolonged drought commencing with October and lasting till about the middle of December. It interfered greatly with the germination of the rabi crops.

The weather during the remainder of the cold weather proved, on the other hand, exceedingly favourable to rabi crops, several good showers having been received during this period.

The effect of the season on individual crops on the Farm will be noticed in detail when dealing with these crops.

An outbreak of rinderpest among the Farm cattle in August 1906 was noticed in my last annual report. A similar but milder outbreak occurred in March 1908. All the cattle were promptly inoculated and none died. The outbreak lasted a short time and caused no special inconvenience.

Programme of experiments, 1907-1908.

10. The programme included—

I.—Variety experiments with—

(1) Coarse winter rice.
(2) Fine winter rice.
(3) Autumn rice.
(4) Sugarcane.
(5) Wheat.

II.—Manure experiments in—

(1) Winter rice.
(2) Sugarcane.
(3) Wheat.

III.—Seed selection with—

(1) Local variety of coarse winter rice.
(2) Local variety of fine winter rice.

IV.—New crop.—Potato.

V.—Trials of new implements.

VI.—Experiments under the control of the Fibre Expert with.—

(1) Jute.
(2) Malancha.
(3) Sida.

ROYAL ASIATIC SOCIETY LIBRARY OF THE BOMBAY BRANCH OF THE

As already mentioned, the variety, manure and seed selection experiments with winter rice had to be abandoned for want of water in the fields for transplanting purposes. The remaining experiments on the programme are dealt with in paragraphs 11 to 16 below.

Variety experiment with *aus* rice.

11. This experiment was intended to contrast a fine variety of *aus* (rainy season) rice from the Central Provinces with a local variety. The experiment was initiated in 1906. In that year, it proved a failure owing to the Central Provinces variety having suffered greatly from extreme heat in May and June and the depredations of pigs. The experiment was repeated in 1907. Seed of Central Provinces rice was obtained afresh from the Bengal Agricultural Department. Two plots, each $\frac{1}{5}$th of an acre, were divided into two equal halves, one of which was sown with Central Provinces and the other with local rice. Seed of both was sown on 30th April and the crops were reaped on 16th August. The treatment of the contrasted plots was exactly alike. The weather was favourable. The results are shown below :—

Plot.	Variety.	Yield of paddy per acre.	Yield of straw per acre.
1	2	3	4
		Mds. srs. ch.	Mds. srs. ch.
71/A	Central Provinces	15 2 8	43 5 0
71/B	Local	23 23 12	60 0 0
	Duplicate		
72/A	Central Provinces	16 1 4	49 30 0
72/B	Local	19 32 8	50 0 0
Average two series	Central Provinces	15 21 14	48 37 8
	Local	21 28 2	55 0 0

The local variety came out much the better of the two. The rate at which the paddy was sold was the same for both as the Central Provinces rice, though much finer in quality, failed to fetch a higher price in the local market. The experiment is being repeated in the current year.

Hitherto no special attention has been paid to the selection of seed in comparative trials of varieties which are continued from year to year. Seed selection is, however, particularly necessary in the case of varieties introduced from abroad; for without it, they are likely to deteriorate. It has been decided, therefore, that all future trials of varieties, whether it be of rice or of any other crop should be combined with a careful system of seed selection.

Variety experiment with sugarcane.

12. An experiment was made to contrast *Dacca Ganderi* cane with the local *Khagri*. This was the second year in which *Dacca Ganderi* was grown on the Farm. In 1906-1907, it gave an extremely heavy outturn of jaggery (142 maunds 26 seers 9 chataks per acre), but there was no means in that year of comparing it with the local variety. During the year under report, the two varieties were planted in three series of plots, the two contrasted plots in each series being exactly alike in respect of area and of quality of the soil, as far as could be judged from external appearance. The aggregate area of the three plots under each variety was $\frac{7}{30}$ths of an acre. The two varieties were planted about the same time in March 1907 and reaped within a few days of each other in February 1908. The *Dacca Ganderi* sets were kept too long in the germinating pit before they were planted in the field and some failed in consequence. The weather also proved dry in the beginning, causing both varieties to germinate somewhat unevenly. On counting the clumps, it was found that there were 1,491 of *Dacca Ganderi* and 1,666 of *Khagri* out of a possible total in each case of 2,120.

A storm in July caused much of the cane to lodge. In other respects, the weather proved favourable.

Previous to planting, the field was manured with cowdung at the rate of 300 maunds per acre; the crop was subsequently top-dressed with castor cake at the rate of 24 maunds to the acre; a deduction was however made in each plot in proportion to the area which remained blank. Thus the three plots under *Dacca Ganderi* received oil cake at the rate of $\frac{14}{21}\frac{1}{0} \times 24$ maunds per acre, and those under *Khagri* at the rate of $\frac{16}{21}\frac{6}{0} \times 24$ maunds per acre. The advantage both in respect of percentage of germination and of the actual quantity of oil cake received, lay with the local cane. The results of the experiment were, however, greatly

in favour of the Dacca variety as will be seen below. The yields of jaggery from the six plots were as follows :—

Plot.	Variety.	Area, in acres.	Actual yield of jaggery.
1	2	3	4
	First series.		Mds. srs. ch.
101A	Dacca Ganderi	$\frac{1}{15}$	7 1 15
101B	Khagri	$\frac{1}{15}$	4 1 4
	Second series.		
102B	Dacca Ganderi	$\frac{1}{15}$	6 26 12
102C	Khagri	$\frac{1}{15}$	3 33 5
	Third series.		
103B	Dacca Ganderi	$\frac{1}{10}$	9 12 15
103A	Khagri	$\frac{1}{10}$	4 37 4
	Total of three series		
	Dacca Ganderi	$\frac{7}{30}$	23 1 10
	Khagri	$\frac{7}{30}$	12 31 13
	Average yield per acre of jaggery.		
	Dacca Ganderi	...	98 29 13
	Khagri	...	54 33 8

The difference in yield in favour of *Dacca Ganderi* thus amounted to nearly 44 maunds to the acre, which, at Rs. 5 per maund the rate at which the gur was actually sold would be equivalent to Rs. 220. The superiority of the Dacca cane was equally pronounced in every one of the three series. There can be no doubt, therefore, that on the soil of the Rajshahi Farm, it would pay far better to grow the Dacca variety than the local *Khagri*. The latter is a hardy variety suited for growing on land that goes under water in the rainy season. But a great deal of *Khagri* is grown on high, dry

sail which never goes under water, and on such soil *Dacca Ganderi* is almost certain to excel the local cane.

The yields of cane, juice and gur and the proportions of these on one another were, as in the statement below which gives the totals for all 3 series of plots:—

—	Dacca Ganderi.	Khagri.
1	2	3
Area.	$\frac{7}{30}$ acre.	$\frac{7}{30}$ acre.
	Mds. srs. ch	Mds. srs. ch.
Total yield of cane	180 39 8	119 26 7
Ditto juice	143 35 10	89 11 12
Ditto gur	23 1 10	12 31 13
Percentage of juice on cane ...	79·5	74·6
Ditto gur on juice ...	16·0	14·3
Ditto gur on cane ...	12·7	10·7

The Dacca variety excelled *Khagri* both in respect of juiciness of cane and in sugar-content of cane and juice. The yield of juice was very high in both canes, but in both cases the juice was rather thin.

The economic results of the experiment, as exhibited below, were also greatly in favour of the Dacca cane.

—	Dacca Ganderi.	Khagri.
1	2	3
Area.	$\frac{7}{30}$ acre.	$\frac{7}{30}$ acre.
	Rs. a. p.	Rs. a. p.
Expenditure	54 8 3	46 13 9
	Mds. srs. ch.	Mds. srs. ch.
Yield of gur	23 1 10	12 31 13
	Rs. a. p.	Rs. a. p.
Value of gur	115 3 3	63 15 7½
Value of cuttings	6 8 0	1 8 0
Total receipts	121 11 3	65 2 7½
Per acre.		
Expenditure	233 10 2	200 13 2
Receipts...	521 9 4	279 4 5
Net profit	287 15 2	78 7 3

13. There were two more fields in which *Dacca Gander* was grown during the year. Both of these were non-experimental. In one which had an area of 9 cottahs ($= \frac{3}{40}$ths of an acre), it was a new crop, and in the other, it was a ratoon crop grown from cane planted in the preceding year. The plant cane was manured with 300 maunds of cowdung and 24 maunds of castor cake per acre and gave a very high yield of jaggery, amounting to 128 maunds 27 seers per acre. The cost of cultivation per acre was Rs. 350 and the income Rs. 643-5-4, leaving a net profit of Rs 293-5-4. The yield of juice amounted to 72·3 per cent. on the weight of cane and the yield of gur to 15·7 per cent. on the weight of juice and 11·8 per cent. on the weight of cane.

The ratoon plot measured one-fifth of an an acre and yielded 10 maunds of jaggery, equivalent to 50 maunds per acre. It was manured with 24 maunds of castor cake per acre. The cost of cultivation per acre amounted to Rs. 186-6-6 and the income including the price of cuttings (201) to Rs. 253-9-6, leaving a net profit of Rs. 67-3-0.

Variety experiment with wheat.

14. This experiment was intended to contrast the soft white Muzaffarnagar wheat with the hard red wheat grown commonly in Rajshahi district. Muzaffarnagar seed was obtained from the United Provinces. The experiment was made in two contiguous fields, each $\frac{4}{5}$ths of an acre in extent. Neither received any manure, and both were treated alike. The yields per acre of the two varieties were: —

—	Grain.			Straw.		
1	2			3		
	Mds.	srs.	ch.	Mds.	srs.	ch.
Local	16	7	13	50	18	12
Muzaffarnagar	13	16	11	27	1	4

Thus in respect of both grain and straw, the local variety proved more productive than Muzaffanagar wheat. Both sold at the same price in the local market.

Sugarcane-manure experiment.

15. This experiment was intended to contrast the effect of the following manures :—

(1)	Cowdung	...	300	maunds per acre.
(2)	Cowdung	...	300	
	Castor-cake	...	24	,, ,,
(3)	Cowdung	...	300	,, ,,
	Super	...	6	,, ,,
	Saltpetre	...	2	,, ,,

These manures had been compared in the previous year (1906-1907), but the crop having been damaged by wild pigs in that year, the experiments did not yield any very definite results. During the year under report three series of plots, each consisting of three plots of $\frac{1}{15}$th of an acre each, were taken for the experiment. Cowdung at the rate of 300 maunds per acre was applied to each plot before the cane sets were planted. The crop came up well, but a heavy storm in July caused it to lodge more or less in all the plots. In two out of the three series of plots, only one half of the prescribed doses of oilcake, super and saltpetre had been applied before the storm and the canes were so badly lodged that it was found impracticable to lift them and apply the remainder of the manure. These two series consequently became useless for the experiment and are accordingly excluded from consideration. In the third series the canes were lifted and propped up with bamboos and the two plots received full doses of the artificial manures designed for them. The yields of gur obtained from the series were as follows :—

Serial No.	Manure per acre.		Yield of gur per acre.			
1	2		3	4		
			Mds.	Mds.	srs.	ch.
1	Cowdung		300	50	32	8
2	Cowdung		300	55	10	10
	Castor cake		24			
3	Cowdung		300	59	24	1
	Super		6			
	Saltpetre		2			

The economic results were as follows, the value of cowdung which was common to all the three plots being excluded from consideration.

Manure used in addition to cowdung.	Cost of additional manure.			Increase in yield of gur.			Value of increase in yield at Rs. 5 per maund.			Profit+or loss—from use of additional manure.		
1	2			3			4			5		
	Rs.	a.	p.	Mds.	srs.	ch.	Rs.	a.	p.	Rs.	a.	p.
1.	...			...			...			...		
2. Castor cake, 24 maunds at Rs. 2-8 per maund.	60	0	0	4	18	2	22	4	2	—37	11	2
3. Super, 6 maunds at Rs. 2-13 and saltpetre, 2 maunds at Rs. 7-3.	31	14	0	8	31	9	43	15	1½	+12	1	1½

In 1906-1907 the addition of 24 maunds of castorcake increased the yield of jaggery by 9 maunds as against about half that quantity in the year under report. In neither year was the increase sufficient to cover the cost of caster cake at Rs 2-8 per maund. Comparing the effects of super and saltpetre with those of castor cake, it will be found on reference to my last annual report that in 1906-1907, the latter gave 6 maunds 28½ seers more jaggery than the former, while the reverse is the case during the year under report. Taking the results of the two years together and considering the relative prices of the manures, it would seem that the use of super and saltpetre on sugarcane might pay as well as, if not better than castor-cake. The margin of profit left after deducting the cost of these manures is however so narrow that one should hesitate to recommend their use, at all events in the heavy doses adopted in our experiment, in places where an abundant supply of cattle manure is available.

Manure experiment with wheat.

16. An experiment was made on eight plots of land, each $\frac{1}{5}$th of an acre, and lying in a row with the object of testing the effect of green manuring with cowpeas. Four alternate plots had been cropped with cowpeas in the rains of 1906 and in the subsequent winter all the eight

plots were sown with wheat. The crops suffered from excessive rain at the beginning of the season and from rust later on, and gave very poor yields which afforded no proper basis for comparison. The plots were bare-fallowed during the rains of 1907 and were then again sown with wheat, with a view to ascertain the residual effect of the green manure used in 1906. Average samples of soil taken from the eight plots failed on analysis to show that the soil of the green manured plots was any richer than that of the plots which had not been so treated. The season was very dry and unpropitious in the beginning but proved favourable from the middle of December onwards. The crop grew evenly enough within each plot, but showed very unequal growth in the several plots, a fact which could only be ascribed to inherent differences in fertility. The yields of grain and straw are given below, and though they would appear to vary within very wide limits, it might perhaps not be unsafe to compare the average of the green manured plots with that of the plots which received no manure.

Plot.	Manure used.	Yields.	
		Grains.	Straw (bhusa).
1	2	3	4
		Mds. srs. ch.	Mds. srs. ch.
63	Green manured with cowpea in 1906	3 16 4	8 30 0
65	Ditto ditto ...	1 9 0	4 30 0
67	Ditto ditto ...	1 12 0	5 30 0
69	Ditto ditto ...	1 35 12	5 20 0
	Total of 4 plots (1/8ths acre) ...	7 33 0	24 30 0
64	No manure	2 38 4	6 15 0
66	Ditto	0 32 8	4 20 0
68	Ditto	0 36 4	5 20 0
70	Ditto	2 35 0	7 17 0
	Total of 4 plots (1/8ths acre) ...	7 22 0	23 32 0
	Yield per acre.		
	Green manured with cowpea in 1906	9 31 4	30 37 8
	No manure	9 17 8	29 30 0
	Increase	0 13 12	1 7 8

The increases in grain and straw were practically insignificant.

Potato a new crop.

17. The potato crop is still new to Rajshahi district. Patches of it are grown in the gardens of well-to-do people, but to the rayats the crop is still unknown. The object of the experiment was to see whether potatoes could be grown as a field crop without the help of irrigation on soil of suitable character in the climate of Rajshahi. This experiment which was made for the first time at the Rajshahi Farm proved very successful.

The soil selected for the experiment is of a loamy description. The crop was grown in four separate fields; the particulars of area and treatment of each field are noted below.

Serial No.	Plots.	Area.	Manure per acre.	Quantity of seed used.	Date of planting.	Crop on land during the preceding rains.
1	2	3	4	5	6	7
		Acre.		Mds. srs. ch.		
1	98, 99 & 100 ...	¼	300 maunds of cowdung	3 24 8	24th Oct 1907	...
2	114A ...	¼	Ditto ditto .	1 17 8	25th „ „	Maize.
3	101C ...	¼	Nil.	0 19 4	1st Nov. 1907	Ditto.
4	102A ..	¼	Nil.	0 19 4	1st „ „	Ditto.

The three plots 98 to 100 were treated as one field. Plots 101C and 102A formed no part of the experiment but were planted with potatoes to utilise the seed left over after planting the experimental area (plots 98 to 100 and 114A). The first field remained fallow during the rains during which time it received frequent ploughings. The other three fields bore maize in the rains; of these three, plot 114A alone was manured with cowdung. The other two received no manure whatever, except that they had been manured with 300 maunds of cowdung per acre for the maize crop. The results of the differential treatment of the four fields are clearly evident in the yields obtained from them.

The variety of potatoes grown was a round red kind, obtained from Darjeeling district but known as Patna in Bengal. The seed was selected by the Superintendent, Babu H. K. Guha, who visited Darjeeling for the purpose.

The seed rate was uniform in all the fields and amounted to 7 maunds 9 seers per acre, which is about half of the usual rate of seeding obtaining in the potato-growing regions of the province. This low seed-rate was secured by cutting the seed-tubers into two or more pieces according to size, the larger ones giving as many as five or six sets. One of the obstacles to the rapid extension of potato cultivation in the province is the initial cost of the seed. This obstacle can be overcome to a great extent by using cut sets. I cannot, however, recommend the use of cut sets in every case. It would be inadvisable to use cut sets with the long or kidney shaped varieties of which the buds or "eyes" are as a rule not so well developed as in the round varieties, or with the country varieties, the seed of which has deteriorated by being kept in a hot climate from year to year. In dry soil too, cut sets are likely to suffer from defective germination.

For several weeks before and after planting, there was practically no rain, and it was found necessary in consequence to help the potatoes to germinate with a slight watering from the can. Beyond this the crop received no irrigation. In ordinary years, I should think there would be no necessity for the slight watering that was given. Good rain was received in the middle of December; this, together with the showers which fell in January and February, proved very helpful to the crop.

The crop was gathered between the 5th and 12th March. The yields of the four fields were as follows:—

Field.	Area.	Actual yield.	Outturn per acre.	Ratio between seed and yield.
1	2	3	4	5
	Acre.	Mds. srs. ch.	Mds. srs. ch.	
Plots 98 to 100	½	107 13 5	214 26 10	1 : 29·7
114A	⅛	23 39 0	119 35 0	1 : 16·7
101C	1/15	1 35 0	28 5 0	1 : 3·9
102A	1/15	2 3 8	31 12 8	1 : 4·3

A small portion of the crop was lost through petty thefts which, in spite of the precautions taken, could not be wholly prevented, and some loss was also caused by rats.

The yield obtained from the first field was very satisfactory. That from the second field (114A) was less satisfactory, though judged by country standards, it was a fair crop. The much larger outturn from the first field was due to the fact that it had been bare-fallowed during the rains, while the second field had borne a crop of maize.

The yields obtained from the last two plots were extremely poor and emphasize the necessity of manuring the land liberally for a potato crop. The 300 maunds of cowdung which was applied to the maize evidently left little residue for the benefit of the succeeding crop.

The economic results of the experiment were as follow:—

Field.	Area.	Cost of cultivation and seed.	Value of yield.	Profit + or loss—
1	2	3	4	5
	Acre.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Plots 98 to 100	$\frac{1}{2}$	63 3 6	181 2 6	+117 15 0
114A	$\frac{1}{6}$	24 7 6	40 7 3	+15 15 9
101C	$\frac{1}{176}$	6 14 0	3 2 9	−3 11 3
102A	$\frac{17}{176}$	6 14 0	3 8 6	−3 5 6
Total ...	$\frac{5}{8}$	101 7 0	228 5 0	126 14 6

The net result was a profit of Rs. 126-14-6 from the potato crop of the year. The profit from the first field was no less than Rs. 235 per acre. This experiment has been made only for one year and that not a particularly favourable one, but the results leave little doubt that with proper cultivation and on suitable soil, potatoes can be grown successfully and profitably in the climate of Rajshahi, though that is one of the driest districts in the province; and though irrigation would undoubtedly increase the yield, it is by no means indispensable. The success of the potato experiment has attracted the attention of neighbouring rayats, and it is to be hoped that before long the cultivation of this staple will be established in the district. Several

gentlemen of the town and some rayats in the neighbourhood took seed potatoes from the Farm last year, and I understand they have obtained good results.

Jute experiments.

18. Jute experiments were made under the supervision of Mr. Finlow, the Fibre Expert. The programme included five separate experiments of which only two were actually brought to completion, *viz.*—

(1) To test the merits of the following six varieties of jute, all belonging to the species Corchorus capsularis :—

Deswal (Pabna).

Desi (Dacca).

Amonia (Faridpur).

Aus (Jamalpur).

Kakiya Bombai (Pabna).

A variety grown in the previous year on the Rajshahi Farm specially for seed.

(2) To test the merits of two more varieties of Corchorus capsularis :—

Barapata (Serajganj).

Baron (Mymensingh).

The remaining three experiments were designed respectively (1) to test the effects of 8 maunds of castor-cake against 155 maunds cow-dung, (2) to compare the result of harvesting the crop at different stages and (3) to compare the economic results of taking a crop of winter rice after jute with those of growing jute alone during the year. These three experiments had to be abandoned owing to adverse weather conditions. The crop was sown in April, but in consequence of drought, came up so unevenly that it had to be ploughed up at the end of May when a second sowing was made. This also failed owing to the monsoon rains setting in soon after and preventing the plants from making proper growth.

In both the variety experiments mentioned above, the crop suffered from unseasonable weather at sowing time and made poor and more or less uneven growth. The results of the experiments must, therefore, be regarded as unreliable. The usual manuring of 5 tons of cowdung per acre was given and the crop was sown on 13th April and reaped between the 23rd September and 1st October in the

first experiment, and on the 5th October in the second. Scarcity of steeping water and of labour for stripping the fibre interfered also to some extent with the success of the experiments. The average yields of fibre from the several varieties were as below :—

	Mds.	srs.	ch.
In the First experiment—			
Deswal	11	14	10
Desi	9	33	9
Amonia	11	28	5
Aus	14	38	2
Kakiya Bombai	9	12	15
Rajshahi Farm variety	8	4	13
In the Second experiment—			
Barapata	5	18	12
Baron	6	7	3

The yields were uniformly poor, and do not afford a safe basis for comparing the merits of the varieties under trial. The result is greatly to be deplored. By deepening the shallow *jhil* on the farm, the supply of steeping water has now been increased and the area under fibre crops in 1908 has been reduced to such dimensions that an adequate supply of labour and water can be relied on.

Ma'ancha.

Malancha (Malachra capitata) is a new fibre crop which has now been cultivated at Rajshahi for three years. In 1905 it was grown on $\frac{1}{10}$th of an acre. In the following year it was cultivated on two-fifths of an acre and yielded 7 maunds 2½ seers of fibre per acre. During 1907 it was grown again on two-fifths of an acre under Mr. Finlow's direction. The land was manured with cowding at the rate of 5 tons per acre. Seed was sown on 25th March and the crop reaped on 30th October. Dry weather at first checked the growth of the crop but subsequent rainfall proved favourable. The yield of fibre amounted to 6 maunds 19½ seers per acre. The fibre has not yet been valued.

Sida.

20. Under Mr. Finlow's direction, one-tenth of an acre was cultivated in 1907 with Sida, a plant which has long been known to yield good fibre, though it has not hitherto been taken up on a commercial scale. The land was manured with 5 tons of cowdung per acre. Seed supplied by Mr. Finlow was sown nc

the 20th May, rather late in the season. The plants grew to a fair height (3½ to 5 feet) and were harvested on the 6th November. The total weight of stems from one-tenth of an acre was 9 maunds 36 seers. Owing to the dearth of water, only one-third of this quantity, *viz*, 3 maunds 12 seers was taken and steeped for ten days. On stripping, this yielded 5½ seers of fibre equivalent to an outturn of 4 maunds 5 seers per acre. Sown earlier, *i. e.*, about the same time as jute, a larger outturn may be expected. A yield of 6 to 7 maunds per acre of sida fibre has been obtained at Pusa and it has been valued at Rs. 11 per maund when the top quotation for jute was about Rs. 8. But unless much larger yields can be secured, there is no chance of sida being able to compete with jute in this province.

Non-experimental crops.

21. The details of the nonexperimental crops grown during the year are shown in the following statement.

Crop.	Area.	Manure per acre.	Actual yield.	Value of yield.	Expenditure.	Profit.	Loss.	Remarks.
1	2	3	4	5	6	7	8	9
	Acres.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Maize	0·83	Cowdung 300 maunds ...	Cobs 3,345 Fodder 192½ maunds	40 13 0	23 9 0	18 4 0	...	Fodder fed to farm cattle valued at 2 annas per maund.
Wheat (Local-red) ...	0·40	Nil ...	Grain 5 maunds 38 seers, straw 19 maunds 35 seers.	28 10 0	17 3 0	11 7 0	...	Wheat at Rs. 4-8-0 and Straw at as. 1-6 per maund.
Ditto ...	0·25	Cowpea sown on 24th April 1907 and ploughed in 20th September 1907.	Grain 31 seers, Straw 3½ maunds.	3 13 9	5 9 6	...	1 11 9	Ditto.
Oats	0·69	Nil ...	Grain 15 maunds Straw 19½ maunds.	31 13 3	26 13 0	5 0 3	...	Grain at Rs. 2 and Straw at as. 1-6 per maund.
Gram	2·33	Nil ...	Grain 52 maunds 1½ seers, Straw 27 maunds.	98 10 0	27 15 0	70 10 3	...	Grain at Rs. 3 and Straw at as. 1-6 per maund.
Jowar	1·50	Nil ...	Fodder 261 maunds, 16 seers, 14 chitaks.	26 2 3	21 4 0	4 13 6	...	Fodder valued at 10 maunds to the rupee.
Sugarcane-(Ghatoon, Khagri)	1·13	Castorcake 4 maunds 23 Seers.	Jaggery 21 maunds. 23 seers, 8 chitaks.	60 9 9	89 8 9	...	23 15 0	The crops suffered greatly from drought in October, November, and first half of December.

Sugar making demonstration with the Hadi apparatus.

22. Between December and February the Hadi sugar making apparatus was tried on the farm. Two professional sugar boilers from the United Provinces were engaged to make the demonstration. Sugarcane was purchased from neighbouring rayats on the field at Rs. 7 per 22 maunds of cane. The amount of cane crushed and the quantities of juice and rab obtained were as follows :—

	Mds.
Cane	2,275½
Juice	1,583
Rab	213

This gives—

Percentage of juice on cane	69·0
Ditto rab on juice	13·5
Ditto rab on cane	9·3

The cane was fairly rich in juice but the yield of rab was very low; of the 213 maunds of rab produced, 110½ maunds were used for making Sugar with the centrifugal machine, while the remaining 102½ maunds were sold as gur. On being treated in the centrifugal machine, the 110½ maunds of rab yielded 39½ maunds of Sugar and 69¾ maunds of molasses, which later on being reboiled gave 51⅓ maunds of 2nd quality rab. The yields of Sugar and 2nd quality rab amounted to 35·8 per cent and 46·6 per cent. respectively, on the weight of rab, thus giving a loss of 17·6 per cent in the manufacture. This loss is unreasonably high. The percentage outturn of Sugar is exceedingly *low*. In trials made by the Inventor of the apparatus, the percentage of sugar obtained varied from 40 to 52 per cent. of the weight of rab. The total expenditure in connection with demonstration amounted to Rs. 1,674 while, the income from sales of sugar and rab only amounted to Rs. 951. This gives a loss of Rs. 723.

The chief causes of the failure of the demonstration at Rajshahi were—

1. The high price paid to the rayats for cane. This including the cost of cutting and carting, was 50 per cent. higher than that usually paid for cane in Upper India.

2. The excessive cost of crushing the cane which works out at nearly 3 times the cost of this operation in Upper India.

3. The poor quality of the juice which only gave 13·5 per cent of rab. At Barpathar an average of 20 per cent was obtained and in the United Provinces the amount varies from 19½ per cent. to 21½ per cent.

We suspect that the cause of the poor quality of the juice is due to the cane being harvested before it was ripe.

4. The cost of boiling and potting the rab came to Re. 1-5-0 per maund, as against less than As. 8 per maund at Barpathar and As. 4 per maund in the United Provinces.

Also the cost of centrifugalling was three times as much as at Barpathar.

5. The demonstration was not under constant expert supervision. The Farm Superintendent was in charge, but was away part of the time, buying cane and arranging for cutting and carting it.

[The same apparatus was subsequently taken to Barpathar in Assam where it gave very successful results the details of which are being published separately.—S. G. Hart].

Supply of seeds.

23. The following seeds were distributed by the farm during the year:—

Oats	15 Mds.
Sugar cane cuttings, Dacca Ganderi ...	6,000 Cuttings (Tops)
Groundnuts	5¼ Mds.
Potatoes, Darjeeling	45½ „
Ditto Naimital	7½ „
Cowpeas	4 „
Jowar	34½ Srs.
Jute	8 Mds. 1 Sr.
Paddy—Dadkhani	20 Srs.
Ditto—Kataribhag	20 „

Receipts and expenditure.

24. The total receipts for the year under report amounted to Rs. 2,074-11-5. The total expenditure was Rs. 10,274-7-6, which included Rs. 2,234-10-6 for capital charges and Rs. 2,148-1-3 for pay and Travelling Allowance of the establishment.

New implements.

25. Hindustan ploughs are in constant use on the farm and do good work.

Planet junior hand-hoes are found useful for interculture between the rows of mulberry and young Sugarcane.

A zigzag harrow has also been tried and does useful work.

Visits of Inspecting Officers.

26. The Farm was inspected there times during the year by the Director of Agriculture, five times by the Assistant Director of Agriculture, and once by Mr. A. G. Birt, in Company with the Assistant Director.

The Collector of Rajshahi, Mr. H. C. Barnes, visited the Farm several times and the Commissioner of the Division made one visit.

ANNUAL REPORT OF THE JORHAT AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1908.

Introduction.

This station was established in January 1906, and is devoted principally to the investigation of sugarcane. The present report deals with the crops grown during the second year of cultivation, namely, during the rains of 1907 and the cold weather of 1907-1908. The young crops, including sugarcane, on the ground at the close of the year (30th June 1908) will be dealt with in the next Annual Report.

History and description.

2. The farm is situated about three miles to the south of Jorhat town. The total area of the farm is 35·5 acres, out of which 1·7 acres is low land, which had been cultivated with winter rice for many years before the farm was started, and the rest is high land, which was under pasture grass and light scrub jungle at the time it was acquired.

Soil.

3. The soil of the farm is a sandy loam of a slightly reddish colour and belongs to the formation known as the "old alluvium". This type of soil occurs over extensive tracts in the Assam Valley, and is often cropped with sugarcane in certain localities, notably in Golaghat subdivision which adjoins Jorhat subdivision on the west. It is expected that any useful results obtained with sugarcane on the Jorhat Farm will apply to the large area of country in the Assam Valley containing soil of the same description and origin.

Four samples of surface soil taken from the four main bocks of the farm, together with four corresponding samples of sub-soil, were analysed during the year by the Imperial Agricultural Chemist at Pusa. His report is subjoined.

Report on the composition of 8 samples of soil and sub-soil from the Jorhat Farm.

	North east field.		South east field.		South field.		West field.	
	Soil.	Sub-soil.	Soil.	Sub-soil.	Soil.	Sub-soil	Soil.	Sub-soil.
1	2	3	4	5	6	7	8	9
Total lime	·07	·056	·028	·056	·028	·09	·056	·070
Calcium carbonate	·091	·078	·045	·091	·158	·091	·045	·091
Organic carbon	1·16	·476	1·18	·468	1·294	·593	·980	·426
Organic nitrogen	·101	·056	·102	·052	·108	·05	·101	·053
Total phosphoric acid	·045	·029	·052	·028	·073	·053	·037	·029
Available phosphoric acid ...	·0056	·0037	·0040	·0010	·0050	·0017	·0033	·0010
Total potash	·299	·203	·317	·317	·211	·1.3	·260	·355
Available potash	·0039	·0023	·0035		·0050	·0043	·0063	·0031
Elutriation analysis.								
Mean diameter of particles m. m.—								
·002	·02	·08	·03	·16	·03	·20	·20	·2
·002-·004	·29	1·93	1·20	8·56	1·69	3·39	1·42	3·65
·004-·008	2·26	3·50	3·58	5·80	4·48	5·53	4·12	5·41
·008-·016	3·03	4·54	4·99	8·79	5·08	8·16	4·87	5·88
·016-·048	19·50	21·17	28·07	38·46	27·05	26·01	23·32	25·79
·048-·140	68·20	64·29	54·[illegible]	27·05	44·03	41·16	57·98	55·96
·14	6·35	4·19	8·03	13·26	17·59	15·56	8·09	3·54

There is great uniformity among these soils, and no appreciable difference exists between any of them. They are all deficient in lime; the carbonate of lime has been calculated from the carbonate present and is probably rather more than really exists as calcium carbonate. The amount of organic matters as indicated by the organic carbon and nitrogen is higher than the common to Indian soils. Although there is abundance of potash, the available portion is very small and that of available phosphate is also, very small. It will certainly pay to manure with superphosphate and possible with potash salts. The mechanical analysis shows the soil to consist almost entirely of moderately find sand.

Preparation of the land for experimental cultivation.

4. The surface of the land was uneven to start with. A great deal of work had to be done to bring it to a farily uniform level. This has caused considerable disturbance of the surface soil and a consequent want of uniformity in regard to fertility. To remedy this defect, the plan which we followed in the first year and which we propose to continue was to subject the land to a uniform system of

cropping. It was hoped that the appearance of the crops would enable the surface of the Farm to be plotted out into areas of uniform fertility. With this object in view, one of the four blocks of land was cropped in the first year with maize and oats, and the remaining three blocks (except a certain area which was bearing sugarcane at the time) with oats alone. The oats failed over the greater portion of the area, and consequently gave no assistance towards ascertaining what are the areas of fairly uniform fertility. It was eventually decided, in consultation with Dr. H. Mann, to abandon the attempt to plot out the Farm in areas of uniform fertility, and to substitute in its place the plan of dividing the culturable area into plots of convenient size, and cropping each without manure for some years till by repeated ploughings and harrowings, all are reduced to a uniform level of fertility. This plan was pursued during the year under report. The whole of the culturable area has now been divided into plots of one twentieth of an acre in multiples thereof. A certain number of these plots will have to be taken up from time to time for experimental cultivation, but the remainder of the Farm will be cultivated and cropped without manure until adjoining plots are reduced to a fairly uniform level of fertility and thus rendered suitable for purposes of comparative experiment.

Buildings.

5. The following buildings were constructed during the year—a godown 50′ × 20′ and a combined Rest-house and office, at a cost of Rs. 3,067-7-6 and quarters for the Superintendent of the Farm, Rs. 1,836. The Superintendent removed to his house, on the farm, just before the end of the year. Previously to that had to live in the town 3 miles away for want of accommodation in the farm—a circumstance which seriously interfered with the efficiency of its working.

A permanent cattle shed, estimated to cost Rs. 2,000, is now under construction.

Water-supply.

6. A plentiful supply of water, both for drinking and irrigation purposes, has been secured by damming up and deepening a ravine. The work, which had been commenced in the previous year, was completed during the year under report, and has cost Rs. 800.

7. Among the implements used at the farm, mention should be made of the following : —

Improved implements.

	Rs.	a.
(1) The Hindustan plough, price	24	8
(2) Avery's plough ,, ...	27	0
(3) Rajeswar's plough ,, ...	8	0
(4) Trucker Cultivator ,, ...	16	0
(5) Cultivator from Messrs. Macbeth & Co., Bombay	61	12
(6) Planet Junior hand hoe, single wheel ...	22	8
(7) 3 roller Behea iron sugar mills	85	0
(8) Ditto, Ram Narayan Banerji's factory, Calcutta	70	0
(9) Wooden roller, locally made	25	0

The Hindustan and Avery's plough have been doing excellent work in the farm. Avery's plough goes about 9 inches, and in loose soil, up to a foot deep. It is provided with a mould board for inverting the soil, and cuts a clean furrow. It is too heavy for Assamese cattle, but is drawn with ease by imported Behar (Marangial) cattle which are being used to an increasing extent by well-to-do cultivators in Assam. Rajeswar's plough is the invention of the Superintendent of the Farm and is an improvement on the pattern of plough he brought out a few years ago. It is of exceedingly simple construction, and consists of an ordinary country wooden plough to which a plate of wrought iron serving the purpose of both mould board and share is attached. I have not had an opportunity of seeing it at work, and am unble at present to say anything about its merits, except that it seems effective, and being cheap and of simple make, is likely to suit the conditions of the country better than expensive ploughs of European manufacture.

The Cultivator purchased in the previous year from Messrs. Macbeth & Company, Bombay, has been found useful for the final preparation of land and also for gathering weeds, but is complained of as rather heavy, and certainly too expensive an implement to suit the Assam raiyat. The Trucker Cultivator has been used in the final preparation of land for jute and ground nuts, and found to work well. It is of lighter draught than Macbeth's Cultivator and can be

drawn by a good pair of Assamese cattle, and, being at the same time much less expensive, it is altogether a more suitable implement than the latter.

The Planet Junior hand hoe is found very useful for the interculture of sugarcane and in making furrows for planting cane and other crops.

The two types of iron sugar mill used in the farm were found to be of practically equal efficiency. The primitive wooden mill is still used by the Assamese cultivator. The only people in Assam who use iron mills are Nepalese and other foreign settlers who grow sugarcane in temporary forest clearings. These men are usually financed by Marwari shopkeepers and are furnished by them with iron mills of cheap make from Calcutta. There is a good opening in the Assam Valley for the introduction of good iron mills, and I would commend this suggestion to the notice of enterprizing firms like Messrs. Renwick & Company of Kushtia through whose exertions the old wooden mill has been wholly superseded by the iron mill over the greater portion of Rajshahi Division.

The Jorhat Exhibition held in February last offered a suitable opportunity for demonstrating to crowds of cultivators the efficiency of the 3-roller iron mill as compared with that of the country implement. A new wooden mill, constructed at a cost of Rs. 20 was worked side by side with an iron mill for ten days, and the results left no doubt as to the superiority of the iron mill, as will appear from the following details :—

Date.	Weight of sugar cane issued to each mill.	Iron mill.		Country wooden mill.	
		Weight of juice expressed.	Time taken in crushing.	Weight of juice expressed.	Time taken in crushing.
1	2	3	4	5	6
	Mds. srs.	Mds. srs.	Hrs. Mts.	Mds. srs.	Hrs. Mts.
February 10th ...	4 32	3 2	2 5	2 27	2 20
„ 11th ...	5 0	2 35½	1 40	2 30	2 0
„ 12th ...	4 0	2 22½	1 30	2 12	1 40
„ 14th ...	3 0	1 37	0 57	1 19	1 17
„ 15th ...	2 11	1 14	0 35	1 4½	0 45
„ 16th ...	4 20	2 24	1 55	2 8	2 10
„ 17th ...	5 10	2 39	2 40	2 32	3 10
„ 18th ...	4 38	3 5	2 25	2 30	2 45
„ 19th ...	4 0	2 25	1 45	2 10	2 2
„ 20th ...	3 0	1 38	0 55	1 18	1 20
Total ..	40 31	25 2	16 27	21 30½	19 29

Every care was taken to ensure a fair trial. The Country mill was placed under the charge of an expert Assamese *gur*-maker, while the Iron mill was run by one of the farm hands. These two maintained a keen contest throughout the trial. Cane was purchased daily from a cultivator in the neighbourhood. As it was not of uniform quality, each day's trial commenced with a division of the cane into two portions equal in quality as well as in weight. It was found that every day, without exception, the Iron mill gave a larger return of juice and took less time than the Country mill. Taking the result of the ten days together, the iron mill yielded 25·1 maunds of juice in 3 hours less time than the wooden mill could produce 21·75 maunds of juice from the same quantity of cane. In other words, for every 100 maunds of juice expressed by the Country mill, the Iron mill would give 115 maunds. The gain of 15 per cent in juice and consequently in *gur*, would repay the extra cost of the iron mill in the course of a single season.

Character of the season.

8. The rainfall recorded at Jorhat during the 12 months ending on 31st March 1908 is shown below. It is needless to quote figures for the quarter ending 30th June 1908, as the rainfall of those months could not affect the crops dealt with in this report.

Month.	1907-1908.		Normal.	
	Rainfall (in inches).	Number of rainy days.	Rainfall (in inches).	Number of rainy days.
1	2	3	4	5
April	6·89	13	8·16	13·4
May	9·41	12	9·62	14·6
June	15·19	20	11·52	15·9
July	11·18	20	15·24	18·2
August	16·13	15	11·32	16·7
September	8·73	16	9·23	13·2
October	2·24	4	4·04	6·4
November	0·08	...	0·54	1·5
December	0·58	2	0·60	1·5
January	0·45	1	0·93	2·9
February	1·43	8	1·41	4·0
March	0·69	2	4·33	8·1
Total of year	73·00	113	80·09	116·4

The total rainfall of the year was short of the normal by 7 inches. There was little rain between the end of September and the middle of February, and what little fell came in driblets which did no appreciable good to the standing crops. The soil became parched, and it was found necessary—a very unusual circumstance in Assam—to irrigate the sugar cane crop which was visibly affected by drought. Heavy and continuous rain in July and August also interfered to some extent with the after-cultivation of this crop.

Programme of experiments, 1907-1908.

9. The only experimental crop grown during the year was sugar cane.

The following experiments were designed :—

(1) To test the merits of several varieties of newly planted cane.

(2) To test the merits of several varieties of cane planted in the preceding year and ratooned in the year under report.

(3) To ascertain the most profitable amounts of cattle manure and oil cake to apply.

(4) An experiment in continuous year-to-year selection of seed cuttings with several varieties of cane with the object of gradually improving their quality.

Variety experiments (1) and (2) with plant and ratoon cane.

10. The following varieties were tested :—

Plant cane.	*Ratoon cane.*
1. Striped Mauritius.	1. Striped Mauritius.
2. Teli.	2. Teli.
3. Samsara.	3. Samsara.
4. Paunda.	4. Paunda.
5. Mag.	5. Mag.
6. Khari.	6. Khari.
7. Majhara.	7. Majhara.
8. Red Mauritius.	
9. Kalapura.	

The ratoon crop had been planted in the preceding year (1906-1907). There had also been plots of red Mauritius and Kalapura in that year, but they were so badly affected by red-rot that very few clumps survived. These two varieties were consequently excluded from the ratoon experiment.

It may be noted here that the selection of cuttings against red smut has not given very satisfactory results. Kalapura seemed at first to have been benefited, but the ratoon crop showed disease and had to be rooted up. Again in the plot planted on 30th May 1908 many plants seemed to be dying a month later and many were already dead.

11. *Treatment of plant cane.*—The nine varieties were planted in plots, each measuring ·05 acres. There were two series of plots; the first series, consisting of nine plots, was planted with the nine varieties, and the second series of eight plots, with eight out of the nine. The *Kalapura* plot, for want of a sufficient supply of cuttings, could not be duplicated. For a similar reason, Red Mauritius occupied only $\frac{3}{5}$th of a plot in the second series.

Cuttings were obtained from the crop of the preceding year. Care was taken to select cuttings which appeared to be free from the red-rot which had declared itself in the previous year in several varieties, notably in the *Red-Mauritius* and *Kalapura*. All cuttings showing the least trace of redness at the cut ends were discarded, and only such as appeared sound were taken for planting.

Following the general Assamese practice, the seed cuttings were first planted in a Nursery, and after they had germinated and produced shoots 12 to 18 inches long, they were taken up and replanted in the field. There were five rows of plants 3 feet apart in each plot, and in each row the clumps stood 2 feet apart. The planting in the field took place about the end of May.

The crop received the following manures:—

Cowdung	...	... 300 maunds per acre.
Rape cake	...	... 20 „ „

The cowdung, following the local custom, was dried and powdered and was applied in 4 separate doses, one at the time of planting and the others at intervals during the rainy season. Rape cake was applied with the last dose of cowdung about the end of August. As the monsoon ceased about the end of September, the soil sown became dry and the oilcake did not get properly decomposed and failed to produce its full effects on the crop. During December and January it was even necessary to irrigate the fields twice.

The crop received five hoeings and three earthings during the rainy season, and one more hoeing after the first watering. No wrapping, stripping or tying was done.

The cane was harvested between the 2nd and 12th March 1908.

12. *Treatment of ratoon cane.*—The ratoon cane occupied two series of plots, each ·05 of an acre. Six out of the seven varieties under trial were given a plot in each series. The seventh (striped Mauritius) was represented in only one series.

As soon as the previous year's plant cane had been harvested (April 1907), the soil round the stumps was hoed and manured with 150 maunds of cowdung and 10 maunds of rape cake to the acre. The crop received two more hoeings and three earthings during the rains. No irrigation was done. The crop was harvested between the 16th and 26th January.

13. *Analysis of juice.*—Samples of juice from each variety of cane, both plant and ratoon, were analysed by the Agricultural Chemist, Mr. A. A. Meggitt, at the time of harvesting. In the case of ratoon cane, he analysed a sample of the juice obtained from duplicate plot, the sample being taken after the whole or nearly the whole of the cane on the plot had been crushed. The analyses quoted in the subjoined statement represent the average of the results obtained from the two plots of each variety of cane. A somewhat different procedure was followed in preparing samples of the juice of the plant canes. Thirty representative clumps were selected from each of the duplicate plots : the canes from the sixty clumps of each variety were crushed together, and a sample of juice taken therefrom. Mr. Meggitt's report is subjoined.

Variety.	Ratoon Cane. Cane sugar per cent.	Glucose per cent.	Total sugar per cent.	*Ratio.* 100 parts total sugar contain per cent. Glucose.	"First year's cane." Cane sugar per cent.	Glucose per cent.	Total sugar per cent.	*Ratio.* 100 parts total sugar contain per cent. Glucose.	Remarks.
1	2	3	4	5	6	7	8	9	10
Striped Mauritius.	16·78	0·63	17·31	3·06	18·33	0·19	18·52	1·02	The figures given are averages of those obtained for the duplicate plots. In most cases there was very close agreement in the results of the duplicate plots of each variety.
Teil ...	16·48	1·04	17·52	5·93	16·36	0·82	17·18	4·77	
Sameera ...	15·22	1·49	16·71	8·91	17·82	0·51	18·33	2·78	
Paunda ...	15·10	1·38	16·48	8·37	17·92	0·53	18·45	2·87	
Mug ...	13·56	1·91	15·47	12·34	16·85	0·41	17·26	2·37	
Khari ...	13·21	2·11	15·32	13·77	15·38	1·22	16·60	7·34	
Majhara ...	9·93	3·59	13·57	26·45	13·50	2·14	15·64	13·68	
Red Mauritius	...	...	...	...	13·65	1·65	15·20	10·19	
Kolapura ...	...	...	...	...	17·46	0·40	17·86	2·23	

"Judging by this year's results, the plant cane is decidedly superior to the ratoon cane. Not only is the percentage of cane sugar higher, but the glucose is much lower in most cases. Whether this would be found to hold in all cases Iam not prepared to say, for I am strongly of opinion that the ratoon cane at the time of harvesting was somewhat overripe. This was unavoidable as the chemical apparatus was delayed in transit, so that the cane had to stand over.

The three varieties that have done worst from the point of view of quality of juice, are Majhara, Red Mauritius and Khari. The juice of those varieties was very low in cane sugar and correspondingly high in glucose. The juice of Majhara contains so high a percentage of glucose and so much

more would undoubtedly be produced, at the expense of the cane sugar, during the boiling process, that the resulting *gur* would be extremely sticky and slimy and absolutely useless for refining purposes.

On the other hand, the *gur* made from the juice of the striped Mauritius, which shows a high cane sugar and low glucose content, was hard, crystalline and of a bright very light colour. The local people, though preferring this kind of *gur*, are not willing to pay more for it than for the inferior kind. Judging the varieties from the point of view of quality of juice alone, striped Mauritius easily takes the lead with Samsara and Paunda following closely. One other good feature of the striped Mauritius at Jorhat this year was seen in its tendency to remain at its optimum condition for a comparatively long time after maturing. That is to say, after ripening, apparently it does not rapidly deteriorate as some varieties would appear to do. During the period of a fortnight, over which I was able to test this point, and possibly it might have extended much longer, there was practically no diminution in the percentage of cane sugar in the juice nor any appreciable increase in the glucose. For all practical purposes, they were both stationary. This is a very important point to bear in mind, and I propose to carry the investigation further next year with other varieties."

14. The gross yields of cane and juice from each variety of plant and ratoon cane are exhibited in the following statement which also shows the percentage of sugar (cane sugar and glucose) and the total quantity of sugar present in the juice, as determined by analysis.

Statement showing yields per acre of Cane and Juice and total Sugar contents of the Juice.

Variety.	Ratoon Cane.					Plant Cane.				
	Yield of Cane.	Yield of Juice.	Per cent. of Juice on Cane.	Per cent. of Sugar in Juice.	Total Sugar content.	Yield of Cane.	Yield of Juice.	Per cent. of Juice on Cane.	Per cent. of Sugar in Juice.	Total Sugar content.
1	2	3	4	5	6	7	8	9	10	11
	Mds.	Mds.			Mds.	Mds.	Mds.			Mds.
1. Striped Mauritius	360·0	220·0	61·1	17·31	38·08	456·5	311·94	69·3	18·52	57·77
2. Teli	379·25	226·5	60·0	17·52	39·68	353·0	229·25	65·0	17·18	39·38
3. Samsara	331·5	231·75	70·2	16·71	39·39	329·75	232·87	70·6	18·53	42·68
4. Paunda	316·0	219·0	69·3	16·48	35·09	335·37	189·57	56·7	18·45	35·03
5. Mag	395·25	292·25	75·8	15·47	45·21	361·25	220·5	61·1	17·26	38·06
6. Khari	622·75	347·75	55·8	15·59	53·28	448·0	266·5	59·4	16·60	44·24
7. Majhara	439·5	266·5	48·0	13·57	28·02	429·75	252·3	58·7	15·64	39·46
8. Red Mauritius	...	...	...	...	...	419·1	255·6	61·0	15·20	38·85
9. Kalapura	...	...	...	...	...	256·5	206·0	69·6	17·00	35·14

In considering the foregoing table, we should remember (1) that the land had not been thoroughly tested for evenness and (2) that some of the differences between the percentages of juice in the different varieties of cane might have been due to unequal expansion. Only very broad conclusions can, therefore, be drawn from the figures exhibited in the table. As plant cane, striped Mauritius heads the list in regard to total yield of cane, richness of juice and total sugar content. This confirms the experience of 1906-1907, when this variety came out best in point of total yield of *gur*. Mr. Meggitt's analysis also shows that striped Mauritius was superior to other varieties in respect of quality of juice, the percentage of glucose to total sugar content being only 1·02.

Next as regards yield of cane and sugar, comes *Khari* which, in the previous year also, came out second best. Judged by analysis its juice is poor in quality, the proportion of glucose to cane sugar being high. But for the manufacture of jaggery (*gur*) this is of minor account, and for this purpose *Khari* would seem to be quite a good cane to grow, especially as in the ratoon experiment it gave a much higher yield of sugar than any other variety. It is probably the hardest of all the varieties under trial, and suffers least from drought and the attacks of insects and jackals. It may be mentioned that cultivation of *Khari* cane has been fostered by the Agricultural Department of Bengal for many years past, and has extended to many places where it was previously unknown.

A continuous study of the growth and behaviour of each of the varieties of sugarcane under trial was made during the growing season. An enormous amount of industry was spent on this work, but I regret to say that the results obtained were not commensurate with the labour involved. Two series of observations were made. In the first, ten average clumps were selected in each plot of plant and ratoon cane, and once a week the number of plants in each clump, the maximum, minimum and average number of canes in each clump, the maximum, minimum and average number of joints in these canes, and the number of canes affected or killed by borer, red smut or other causes were noted. In the second series, every clump of plant and ratoon cane in the variety experiments was kept under observation, and the following particulars were noted once a month:— Number of canes, the height of each cane, the number of joints in each, the number of canes affected or killed by borer,

red smut or other causes, and any other special features that came to notice.

From this mass of observations, I have culled the following figures which may be of interest :—

Ten selected clumps of each Variety.

—	Number of plants that died of—			Number of canes harvested.		Height of canes.	
	Borer.	Red-smut.	Other causes.	Sowed.	Unsowed.	Maximum.	Average.
1	2	3	4	5	6	7	8
Plant cane (first plot).						Inches.	Inches.
1. Striped Mauritius ...	1	6	0	49	2	100	61
2. Red „ ...	0	19	1	33	15	83	58
3. Paunda	3	2	11	46	1	51	30
4. Majhara	9	0	1	55	3	80	45
5. Khari	3	1	4	84	2	92	56
6. Samsara	1	0	4	45	2	41	25
7. Teli	0	0	6	56	7	55	32
8. Mag	5	0	4	54	4	73	44
9. Kalapura	0	7	10	43	6	55	30
Plant cane (duplicate plot).							
1. Striped Mauritius ...	1	5	8	46	3	87	42
2. Red „ ...	0	29	7	38	17	68	36
3. Paunda	5	0	10	30	16	46	27
4. Majhara ...	4	0	3	47	21	68	40
5. Khari	0	0	0	90	7	80	52
6. Samsara	3	0	6	39	6	43	25
7. Teli	0	0	2	55	7	50	31
8. Mag	5	0	3	48	4	62	43
9. Kalapura	No duplicate			...	...	...	...

	Number of plants that died of—			Number of canes harvested.		Height of canes.	
	Borer.	Red smut.	Other causes.	Selected.	Unselected.	Maximum.	Average.
1	2	3	4	5	6	7	8
Ratoon cane (1st plot).						Inches.	Inches.
1. Striped Mauritius	0	5	9	51	13	113	46
2. Red „ ...	...	...	...	None.	...	...	...
3. Paunda ...	2	0	2	73	17	73	44
4. Majhara ...	1	0	7	50	30	102	63
5. Khari ...	0	0	1	108	19	120	84
6. Samsara ...	1	0	5	53	19	67	40
7. Teli ...	2	0	1	70	23	78	48
8. *Mag* ...	0	0	10	45	26	100	64
9. Kalapura ...	...	None.	...	None.	...	...	...
Ratoon cane (duplicate plot).							
1. Striped Mauritius	0	None.	...	None.	...	...	...
2. Red „ ...	0	0	...	None.	...	...	...
3. Paunda ...	0	0	0	52	23	80	49
4. Majhara ...	2	0	6	63	29	106	69
5. Khari ...	0	0	11	105	31	116	82
6. Samsara ...	6	0	4	54	18	81	49
7. Teli ...	1	0	8	67	11	112	56
8. Mag ...	0	2	14	32	18	97	64
9. Kalapura ...	None.	...	...	...	...	...	...

With all Clumps of each Variety.

	Total number of clumps planted.	Total number of canes harvested.					Number of plants that died off during growth.
		Sowed.	Affected by borer.	Affected by red smut.	Affected by other causes.	Total.	
1	2	3	4	5	6	7	8
Plant Cane (1st plot).							
1. Striped Mauritius ...	365	1,277	76	14	1	1,368	194
2. Red ,, ...	365	943	10	392	...	1,345	1,182
3. Paunda	365	1,334	19	...	40	1,393	92
4. Majhara	365	2,130	262	...	13	2,407	334
5. Khari	365	3,047	69	6	2	3,166	105
6. Samsara	365	1,367	78	27	3	1,475	28
7. Tell	365	1,734	83	17	16	1,857	33
8. Mag	365	1,611	140	18	6	1,777	182
9. Kalapura	365	918	33	16	3	970	101
Plant Cane (duplicate plot).							
1. Striped Mauritius ..	365	1,217	51	27	5	1,300	109
2. Red ,, ,,	219	475	62	98	5	640	353
3. Paunda	365	1,080	62	10	15	1,167	52
4. Majhara ... ,,	365	1,944	155	67	...	2,166	145
5. Khari	365	12,597	164	26	...	2,777	110
6. Samsara	365	1,097	65	21	1	1,174	42
7. Tell	365	1,256	103	19	13	1,390	35
8. Mag	365	1,268	102	27	8	1,403	92
9. Kalapura	None.						
Ratoon Cane (1st plot).							
1. Striped Mauritius ...	180	825	50	165	27	1,067	318
2. Red ,, ...	None.						
3. Paunda	180	1,011	106	8	93	1,218	134
4. Majhara	180	1,193	458	39	32	1,632	90
5. Khari	180	1,007	301	14	134	2,356	95
6. Samsara	180	863	236	8	156	1,263	61
7. Teli	180	946	211	14	99	1,270	149
8. Mag	180	641	206	71	112	1,030	152
9. Kalapura	None.						

—	Total number of clumps planted.	Total number of cane harvested.					Number of plants that died off during growth.
		Sowed.	Affected by borer.	Affected by red smut.	Affected by other causes.	Total.	
1	2	3		5	6	7	8
Ratoon (duplicate plot.)							
1. Striped Mauritius ...	None.						
2. Red " ...	None.						
3. Pounda	180	864	18	241	101	1,222	44
4 Majhara	180	1,176	353	3	151	1,683	65
5. Khari	180	1,908	7	212	579	2,706	804
6. Samsara	180	900	165	3	205	1,273	
7. Teli	180	844	165	14	119	1,142	169
8. Mag	180	445	129	41	247	762	210
9. Kalapura	None.						

[The Farm staff had never before been called on to make such an elaborate and tedious system of field notes. It is not surprising therefore to find that the records, especially those made during the *period* of growth, contain many omissions and discrepancies. The notes taken at the time of harvesting are however, fairly reliable, and it does not seem right to pass them over without some comment. The following points may at least be considered to have been established for the sugarcane crop on Jorhat Farm in 1907-1908 :—

(1) The exceeding prevalence of the red smut disease. At harvesting no variety was found free from it. The selection of cuttings free from obvious traces of the disease was not effectual in eliminating the disease, but as the ratoon cane shows the crop would have suffered much more had this measure not been taken.

(2) Red smut was much more prevalent in ratoon than in plant cane.

(3) Nearly as many canes were found damaged by borers as by red smut, but in this respect plant cane suffered quite as much as ratoon cane.

(4) The pounda variety was the least affected by red smut, both in plant and ratoon cane.

(5) Red Mauritius was the variety least affected by borers

(6) In plant cane Khari and Striped Mauritius attained the greatest height; in ratoon cane Khari was easily first.

(7) As the producer of the largest number of canes Khari again stood first with *majhara* second.—S. G. HART.]

Mention was made in my last annual report of four varieties of seedling canes obtained from Barbadoes. These arrived in May 1907, and were first planted in a nursery, the site being subsequently transferred to the field after they had sprouted. The planting was consequently late, and the canes had not time to attain their full growth. It was decided therefore to utilize the whole of these canes for site for the next year.

Manure experiment with sugarcane.

15. An experiment was made partly for our own information and partly as a demonstration to the surrounding raiyats, to ascertain the most profitable amount of cattle dung and oil-cake to apply.

The manures tried were as follows:—

(*a*) Three hundred maunds of cowdung and 20 maunds of rape-cake per acre.

(*b*) One hundred and fifty maunds of cowdung and 10 maunds of rape-cake, per acre.

(*c*) Seventy-five maunds of cowdung and five maunds of rape-cake per acre.

(*d*) Three hundred maunds of cowdung and no oil-cake per acre.

(*e*) One hundred and fifty maunds of cowdung and no oil-cake per acre.

The experiment was made in two series of plots, each consisting of 5 plots of $\frac{1}{20}$th acre each. The variety of cane planted was the local *Mag*. The crop was planted between the 13th and the 22nd June, and received 6 hoeings and two earthings. It was irrigated once in January. Cowdung was applied partly at the time of planting and partly as top dressing in August and September. Rape-cake was applied in September rather late in the season, and as the rains ceased prematurely, it is found that the manure had not time to get sufficiently well incorporated with the soil to show their full effect.

The crop made rather poor growth, though the difference in growth between the plots which received different doses of manure were clearly visible. The results obtained on crushing the canes and boiling the juice into *gur* were vitiated by

different causes which need not be mentioned here. The only criterion we can rely upon to judge of the efficacy of the several manures is the amount of cane harvested from each plot. The average yeild of cane per acre obtained from the two series was as follows :—

Serial No.	Manure per acre.	Yield of cane per acre.
	2	3
		Mds.
1	Cowdung 800 maunds + oil-cake 20 maunds	491
2	Ditto 150 ditto 10 ditto	421
3	Ditto 75 ditto 5 ditto	630½
4	Ditto 300 maunds	334½
5	Ditto 150 ditto	297¼

Selection experiment with sugarcane.

16. An experiment was commenced with the object of evolving superior strains of cane by a process of selection carried on from year to year. Twenty cuttings were taken from the best canes in the healthiest clumps of each of the several varieties grown in 1906-1907. These were planted separately and cultivated and manured in the same way as the crop in the variety experiment; but owing possibly to the rawness of the soil, the plants did not make satisfactory growth, and in spite of the care with which the sets had been selected, the Red Mauritius and Kalapura varieties suffered greatly from red-smut. These two varieties have now been discarded from the selection experiment.

Majhara has also been excluded on account of the inferiority of its juice. The experiment is therefore now being continued with six varieties only.

Fruit trees.

17. A large number of fruit trees, mostly new to the locality, has been planted in the farm from time to time, and a new orchard is

now being laid out. The details of the trees alive at the close of the year are given below :—

Description of trees.	Whence obtained.	Date of planting.	Number.	Remarks.
1	2	3	4	5
Litchi (Muzaffarpur) ...	Mr. S.P.Chatterjee, Calcutta.	23th June 1906	17	
Sorbah lime	Ditto ...	4th May 1906	12	
Local lime	Local	30th July 1906	10	
Sylhet Orange	Tropical plantation, Wahjain.	7th June 1906	32	
U Soh Myndong (Khasi lime) ...	Ditto ...	Ditto ...	10	
Ceylon pineapple	Moriani ...	.....	...	
West Indian pineapple ...	Barbados ...	21st Dec. 1906	2	
Kew pineapple	Tropical plantation, Wahjain.	16th July 1907	2	
Poona strawberry flavoured plantain.	Ditto ...	Ditto ...	7	

All the trees appear to be growing well. Some of the litchi trees appeared at one time to be suffering from a fungus disease and have been greatly benefited by spraying with Bordeaux mixture. Besides the trees enumerated above, a large number of Bangalore and Ceylon papaya seedling has been recently put out along the borders of a road.

Inspection.

18. During the year the farm was inspected once by the Director of Agriculture and three times by me. Mr. F. J. Monahan, Commissioner, Assam Valley, and Major Gurdon, Officiating Commissioner, visited the farm during the year. Mr. Meggitt, Agricultural Chemist, spent a number of days on the farm in making analysis of the sugarcane.

Receipts and expenditure.

19. The expenditure and income of the farm are shown in the following statements:—

Abstract of Expenditure for the year 1907-1908.

Heads.	Amount spent.
1	2
	Rs. a. p.
I.—Capital Charges—	
Buildings (Original Construction) ...	6,211 7 6
Laying out Farm	831 15 0
Reclamation	800 0 0
Excavating tank	178 8 0
Roads, drains and fencing (Original Works), Furniture.	51 0 0
Live stock	127 0 0
mplements (durable)	427 2 9
Total	8,627 1 3
II.—Establishment—	
Pay	1,690 12 0
Travelling allowance	274 7 0
Grain allowance	44 8 0
House allowance	22 0 0
Total	2,071 11 0
(Total of I and II) Carried over ...	10,658 12 3

Abstract of Expenditure for the year 1907-1908—concld.

Heads.	Amount spent.
1	2
	Rs. a. p.
Brought forward (Total of I and II) ...	10,653 12 3
III.—Contingent expenditure—	
Labour	1,815 9 3
Irrigating canes	110 2 0
Buildings (repairs)	239 7 0
Roads, drains and fencing (repairs) ...	344 3 6
Implements (repairs and purchase of country implements and tools).	65 9 0
Manure	436 7 3
Seeds and plants	225 6 9
Cattle food	640 8 6
Stamps	37 0 0
Telegrams	19 10 0
Rents, rates, and taxes	9 4 0
Unspecified charges	286 2 3
House allowance	110 0 0
Total	4,339 5 6
IV.—Grand Total of I, II, and III	14,998 1 9

Abstract of Sale Proceeds for the year 1907-1908.

Heads (state kind and quantity of produce sold).	Sale proceeds.
1	2
	Rs. a. p.
Sale Proceeds—	
Plantai s	8 0 6
Thatch	7 0 0
Paddy	30 8 0
Oats	0 10 0
Gur	528 9 3
Bullocks hire	4 8 0
Total	579 3 9

Annual Report of the Fruit Experiment Station, Shillong, for the year ending 30th June 1908.

Introductory.

The Fruit Experiment Station and the Upper Shillong Agricultural Station are worked practically as one concern. They are managed by the same staff and much of the experimental work is common to both. Among the crops common to the two stations are the fruit trees and potatoes. The main object of the Fruit Station is the cultivation of fruit trees. Some of the fruit trees imported from abroad were for certain reasons, which will be mentioned later on, removed to the Upper Station. I propose, for the sake of convenience, to deal with the cultivation of all the fruit trees in the report of the Fruit Station. For a similar reason all experiments with potatoes will be dealt with in the report of the Upper Shillong Station, where experiments in this crop were commenced several years before the Fruit Station came into existence.

History and description of the garden.

2. The Fruit Garden commenced work in September 1902. The garden owes its inception to Sir Bampfylde Fuller. It is situated in the village of Umlyngka, 3 miles from Shillong, on the Cherrapunji road, nearly midway between the town and the Upper Shillong Station. Its elevation is about 5,200 feet, *i.e.*, about 200 feet higher than the town. It originally comprised an area of 13·4 acres, which was acquired by purchase from the Khasia owners at a cost of Rs. 406-12-9. An additional area of a little over two 2 acres belonging to the adjoining Government forest has been gradually annexed to the Station, which thus has a total area of about 15½ acres. About two-thirds of this area has been brought under cultivation and planted for the most part with fruit trees and mulberry.

The chief object with which the garden was established was to experiment with various kinds of fruit trees grown in the temperate climates of Europe, with a view to introduce such of them as may succeed into the hill districts which possess a temperate or semi-temperate climate not

unlike that of the warmer regions of Europe. The great drawback in the climate of these districts is the early setting in of the monsoon and the consequent excessive humidity of the atmosphere, which interferes with the ripening of fruit. Such fruit as pears, apples, plums, peaches, and apricots are already grown in and about Shillong, but the fruit in almost every case is of an inferior description. It is hoped that by trying a number of varieties of each species, one or more may be found that will ripen early or give good fruit in spite of the rains.

Most of the fruit trees under experiment were obtained from two English firms—Messrs. Bunyard & Co., of Maidstone, and Thomas Rivers & Sons, of Sawbridgeworth, Herts. They arrived in the winter of 1902-1903. Small consignments of plants have since been obtained from time to time from these firms and from Messrs. Kelway & Sons, of Longport, Somerset. Some apples, pears, and Spanish chestnuts were obtained in 1902-1903 from the Saharanpur Botanical Garden. Cuttings of several varieties of grape vines were obtained in 1903 from Kashmir. Several plants also have been propagated from seed. These include cherimoyer, seed of which was obtained in 1903 from the Government Garden in the Southern Shan States, and tree tomato and mountain papaya grown from seed obtained from the Hakgala Garden in Ceylon.

Besides the foregoing, the garden contains small plantations of strawberries, citrons, Khasi oranges, rhubarb, asparagus and a large variety of squash (*Sechium edule*) procured from Madras.

Although most of the fruit trees planted in 1903 grew well, it soon became apparent that the site of the garden, which faces the south and west, was exposed to the high gales which blow from those directions in March, April, and May. It was thought desirable, therefore, to remove some of the trees to a more sheltered place. It was also thought that some of the trees might thrive better at a

higher elevation than the Fruit Garden. Some were accordingly transferred to a field in the Agricultural Station of Upper Shillong, which is about 700 feet higher than the Fruit Garden, and having a north-east aspect, is well sheltered from the high winds. Other trees were removed to the new field adjoining the Fruit Garden. Some of the trees were removed in September 1903 and some in July 1904.

A stone wall 7 feet high and 228 feet long was made in 1906 to protect a certain number of trees from the high winds. Some of these trees were planted with a view to train them on the wall, others at a short distance from the wall, so as to be protected by it from the wind. A row of grape vines has been planted on the windward side of the wall against which they are trained.

Some of the fruit trees are planted on the natural surface of the ground, others on artificial terraces cut out of the hill side.

In 1904, a new line of experiment was initiated at the Fruit Garden, namely, the rearing of the European univoltine silk worm. This experiment has been repeated every year since, and each time with success. A large portion of the garden has been planted with mulberry, chiefly with a view to obtain plants and cuttings for distribution.

An important part of the work carried on at the Fruit Station is the propagation by grafting and budding of such fruit trees as have proved successful, with a view to their distribution to the public. Large numbers of stocks of wild apple, wild pear, peach, plum, wild grape, and Khasi cherry have been planted for this purpose.

Number of fruit trees at the close of the year.

3. Statement I annexed to this report shows the fruit trees which remained alive on the 30th June 1908. Statement II shows the number of stocks planted for grafting purpose existing on the same date.

The following is an abstract of the two statements :—

No.	Species of trees.	Number of trees standing on 30th June.		Number of grafts in nursery on 30th June.		Number of stocks for grafting on 30th June.	
		1907.	1908.	1907.	1908.	1907.	1908.
1	2	3	4	5	6	7	8
1	Apple	37	49	37	59	1,374	1,031
2	Pear	68	134	176	742	2,572	2,263
3	Plum	40	44	1	88	1,190	781
4	Peach	11	14	19	216	97	113
5	Cherry	37	37	...	...	301	321
6	Apricot	3	9	..	89	...	...
7	Almond	5	5	...	...	...	...
8	Walnut	17	17	26(a)	2(a)	...	...
9	Fig	62	54	4(b)	1(b)	7	7
10	Grape	141	141	470(b)	205(b)	10	5
11	Spanish chestnut	75	75	260(a)	45(a)	...	...
12	Cherimoyer	6	6	...	...	...	...
13	Tree tomato	5	6	350(a)	63(a)	...	...
14	Mountain papaya	23	21	110(a)	47(a)	...	...
15	Loquat	3	3	...	..	...	...
16	Guava	5	5	...	...	...	...
17	Khasi orange and citron ...	105	105	...	1	...	...
18	Gooseberry	11	8	...	...	...	...
19	Raspberry	13	11	8(c)	18(d)	...	...
20	Currant	50	88	...	...	...	...
21	Nectarine	6	...	...	22	...	...
22	Quince, common	8	...	...	...	...	...
	Total ...	733	842	1,491	1,967	5,553	4,451

(a) Seedlings.
(b) Rooted cuttings.
(c) Plants imported from England in 1906.
(d) Suckers.

4. Except for a long spell of dry weather in the spring the weather was normal during the period covered by the report.

Weather.

The drought appeared to be favourable to apple trees, as much more fruit set on them than in former years; but on other fruit trees the effect was the reverse, many of them, being in blossom at the time, failed to produce any fruit.

5. *Apple.*—The trees are growing well and most of them have borne fruit, but the apples fall off the trees before they are ripe. The "Thomas Rivers" variety is bearing especially well, the apples being large and well formed, but this variety has the common defect that the fruits fall before ripening.

Progress of the fruit trees.

Pear.—The English pear trees have made fair growth, but the trees from Saharanpur have done much better.

Nine of the Saharanpur trees flowered this year for the first time, but none, except the *LaConte* and *China* varieties set fruit which remained on the tree.

One tree of the Beurre D'Ammanlis variety from England set one fruit, but it fell off before ripening. A large number of grafts have been made of Rossenrhode's pear, a very fine vareity obtained from the late Mr. Rossenrhode's garden in Upper Shillong.

The original name of this variety is not known.

The stock used is the *Soh-Shur*, the wild pear of the Khasi Hills.

Plum.—The trees have grown unequally. Some of them have made a good growth of wood and have blossomed regularly for the past three or four seasons, but none have yet produced fruit. The *Denniston Superb* set a few fruits this season, but they did not mature.

The leaves of the trees were badly attacked by beetles which appeared in May and June.

Peach.—The trees have been in bearing for three or four years. The crop suffered from the long drought in the spring and the ripening fruit was attacked by flies.

The *Early Silver* variety has produced very fine fruit this year. The peaches produced at Shillong are nothing like as good as those grown in Europe. The fruit is rather

sour and has not such an attractive appearance as the European peach.

The lack of fine weather during the ripening season is no doubt answerable for most of its defects.

Cherry.—The cherry trees planted in March 1903, have made good growth, but only two varieties—*viz.*—*May Duke* and *Flemish Red* have fruited.

The trees which were transferred to the Upper Shillong Farm and to the new field at the Fruit Station have suffered from being transplanted a second time and but few of them are growing satisfactorily.

A few trees blossomed this year but *did* not set any fruit.

Apricot.—The trees are growing very slowly. One tree of the *Blenheim* variety set fruits this year, but they dropped off before they were ripe.

Almond.—The trees are growing well. Four trees blossomed this year and set a few fruits which, however, did not mature.

Walnut.—The trees are doing well, but will not be old enough to bear for a long time.

Fig.—Only three of the original trees obtained from England in 1902, survive. The rest have been killed out by a large borer. A large number of young trees have been raised from cuttings taken from the old trees and many of these are in bearing.

Grapes.—The vines, especially the English varieties, have suffered very much from mildew. Three of these were trained on the inside wall of the plant-house while the other three were trained outside. Those outside suffered less from mildew than the ones inside but were damaged by the high winds. All the English vines have now been removed to a terraced field in a more sheltered position. The Kashmir vines were originally planted on a strip of cleared land in the middle of jungle, but they were so badly attacked by beetles which came from the jungle that they had to be removed. Some were transplanted in 1906 on the south side of the stone wall against which they are being trained, and the remainder were removed to the terraced field in 1907.

All the vines are now free from mildew but those planted against the wall suffer from the high winds in the spring.

Several of the English and Kashmir vines are now in bearing. Two plants of the English grape No. 4 and one of No. 5 bore large bunches of grapes this year. The fruit of No. 4 is oval shaped, while that of No. 5 is round.

The fruit of both these varieties is much superior to the Shillong Black grape.

The Shillong Black grape is very prolific and free from disease, but the fruit is rather sour; several plants at the fruit garden were loaded with fruit this year.

Spanish chestnut.—The trees are not doing well. Those on the Upper Shillong Farm are about thirty years old. They blossom profusely every year in May and June, but produce very few nuts. The young trees obtained in 1903 have been badly attacked by beetles, but now this pest has been checked by applications of kerosine and crude oil emulsion and the trees are growing better.

Cherimoyer.—Making good growth. Two of the trees blossomed for the first time this year, but set no fruit.

The trees are susceptible to frost and have to be protected during the winter.

Tree tomato.—This also needs protection from frost. The plants are easily grown from seed and commence to bear in the second year after sowing.

Some of the plants commenced bearing last year.

Mountain papaya.—This is doing well. All the female plants are bearing fruit.

Loquat.—These are doing very well, but are not yet bearing.

Guava.—Growing well. Two trees blossomed this year and set a few fruits which, however, did not remain on the trees long enough to ripen.

Khasi orange and citron.—The orange trees are growing very slowly, but the citrons are doing well and produced some fruits for the first time this year.

Gooseberry, raspberry, and currant.—These are a failure at Shillong. In the rains the trees become diseased, the young shoots die off, and practically no fruit is produced.

Spraying the bushes has been tried and the diseased parts have been removed, but with no effect. The majority of the bushes have died out.

Treatment of the fruit trees, pruning, etc.

6. None of the larger trees were manured this year. The smaller Spanish chestnuts, walnuts, vines and bush-fruits were manured with cow-dung, the soil being removed from about the base of the tree, was mixed with well rotted cowdung and replaced.

All the trees were pruned during the year. Root-pruning was tried on several trees with the object of checking the growth of wood and of inducing them to fruit.

The following is a statement of the number of trees root pruned :—

	Root pruned.	*Bore blossom.*	*Bore fruit.*
Apple	15	15	11
Plum	13	2	1
Pear	10	10	7
Almond	3	3	1
Cherry	11	3	2
Apricot	2	2	...
Cherimoyer	1	1	...

Fungus diseases.

7. The fungus diseases which give the most trouble at the Fruit Farm are the "die back" disease of the bush-fruits and the powdery mildew on the vines. No remedy has been found for "die back" disease.

The diseased shoots are regularly cut off and burnt, but the disease appears again every rainy season.

Applications of potassium sulphide and Bordeaux mixture failed to check the powdery mildew on the vines so long as they were inside the house, but now they have been removed to an open position where they get plenty of sunshine and air, the disease has practically disappeared. The vines which were badly attacked by mildew were sprayed with a 0·3 per cent. solution of sulphuric acid and then dusted with flowers of sulphur.

Strawberries.

8. The variety *Sir John Paxton* having been discarded as being unsuited to Shillong, there are now three varieties at the Fruit Farm, *viz.*, *Aprikose Louise Gautier, and Givon's Late Prolific.* All these varieties are doing well.

The total area under strawberries is now about $\frac{1}{8}$ acre. The yield this year was 36 seers 1 chattak, which was sold at Re. 1-8 per seer, and brought in Rs. 54-2-6.

The yield was much less than last year, the long drought in the spring being unfavourable to the setting of the fruit.

Other crops.

9. These include rhubarb, asparagus, squash (*Sechium edule*), three varieties of American Sweet Potatoes and ground-nut.

Rhubarb and asparagus both do well at Shillong. The figures for the year under report are as follows :—

	Rhubarb	Asparagus.
Area	495 sq. yds.	507 sq. yds.
Yield	3 mds. 13 srs.	2 mds. 12 srs. 1 ch.
Value of yield ...	Rs. 66 8 0	Rs. 69 1 0
Cost of cultivation (exclusive of the value of cowdung used)	„ 30 4 0	„ 38 1 6
Profit	„ 36 4 0	„ 30 15 6

The area under these crops is being gradually extended.

Groundnuts are being grown for the first time at Shillong this year.

The results of the trial will be given in next year's report.

Sweet Potatoes.—Three American varieties have been grown on the Farm since 1904.

These varieties, *viz.*, *New Jersey*, *Virginia*, and *Nonsimmond* were grown this year side by side with the local Khasi Red variety for comparison.

There were three series of four plots, each $\frac{1}{160}$ acre in area. All the plots received 300 maunds of cowdung per acre. The crop was planted in June and harvested in December 1907.

The results are tabulated below :—

Variety.	1st series, yield per plot.	2nd series, yield per plot.	3rd series, yield per plot.	Average yield per acre.
1	2	3	4	5
	Mds. Srs.	Mds. Srs.	Mds. Srs.	Mds.
1. New Jersey	1 15	1 5	1 10	200
2. Virginia	1 10	1 10	1 8	197⅓
3. Nonsimmond	1 5	1 5	1 8	184
4. Local Red	1 10	1 15	1 10	206⅔

Sericulture.

10. Experiments on the rearing of European silk worms have been carried out for the last five years at Shillong. Up till two years ago all the "seed" was imported annually from Europe, but since then "seed" raised locally has been proved to give quite as good results as the imported seed.

Our object in carrying out the experiments at Shillong is to introduce the silk industry into the Khasi Hills. So far we have not been very successful in this, as through lack of knowledge on the part of the few Khasias who have so far made an attempt, the result has been failure.

We have decided therefore to send Khasia boys at Government expense to the Sericultural School at Rajshahi where they will be trained in the rearing of silk worms. On the completion of their training if they have made satisfactory progress they will be given a grant of Rs. 250 each with which to build a silk worm rearing shed, on condition that they agree to plant mulberry and commence the rearing of silk worms at home.

One boy has already been sent to Rajshahi and is making satisfactory progress.

When other suitable candidates are found they will also be sent for a course of training at Rajshahi.

This year we made no experiment ourselves; but, in order to prove that silk worms can be raised successfully by a Khasia with very little outside assistance, we made the following arrangement with a Khasia mali, who works on the Farm:—

(1) That we would provide seed and mulberry leaves and would lend him a rearing house and appliances free of cost.

(2) That he should be paid half wages for 15 days from the time of putting out the eggs to hatch. From then he would be paid no wages up to the time the worms started spinning.

(3) That half the weight of green cocoons would become his property and that we would take the other half.

(4) That we would purchase his share of cocoons at Rs. 2 per seer.

The man made rather a good thing out of it. The total weight of green cocoons was about 32 seers, thus his share of the proceeds amounted to 16 seers which, at Rs. 2 per seer = Rs. 32.

During the period he was occupied in rearing, he lost the following amounts in wages :—

	Rs.
½ wages for 15 days	3
Whole wages for 1 month	12
Total ...	15

Thus he was richer by Rs. 17 than if he had worked the whole time as a mali on the Farm.

He was given a little advice and help by the Farm Superintendent, who also took notes on the experiment.

Three lots of eggs were used, *viz.*—

(1) Var. (raised locally, 3rd generation in India).

(2) Var. (newly imported from France).

(3) Italian Yellow (raised locally, 3rd generation in India).

The two lots of local seed were raised at the Farm from cocoons of 1907. The Superintendent of Sericulture, Bengal, examined the moths which laid the eggs and found them to be free from pebrine. As a further precaution against disease, the eggs of all moths which died within 12 days after laying were destroyed and only those kept for seed which were laid by the moths which lived longest after laying.

Up to and including the year 1906 the eggs were hatched in an incubator kept at a temperature of from 70° to 80°F., but this method has been given up. The method of incubation followed now is for a man to carry the eggs wrapped up in a cloth under his clothes. This is found to answer the purpose very well, the eggs hatching out in five days.

The weight of seed hatched in each lot was as follows :—

(1) Local Var., ⅛ oz. (the produce of 20 moths).

(2) Imported Var., ½ oz.

(3) Local Italian Yellow, ⅛ oz. (the produce of 20 moths).

The lots of seed were kept separate as also were the worms which hatched out.

Unfortunately, soon after the worms were hatched, rats got into the rearing house and destroyed—

2 Trays of Local Var. worms.
3 „ Imported „ „
2 „ Local Italian Yellow worms.

So it is impossible to make a strict comparison of the amounts of cocoons produced by given weights of seed of the different lots.

The temperature of the rearing house varied from 61°F. in the early morning to 66°F. in the afternoon.

The interval from the commencement of hatching to commencement of spinning varied from 39 to 45 days in the various lots. This was rather less than last year when the period varied from 41 to 46 days.

In the first three years of our experiments the cocoons were killed with steam and then dried in a hot case at a temperature of from 80°F. to 100°F. This was a very slow process, and took some days to complete. So, for the last two years the cocoons were placed in a small stone oven which was heated up till you could only just bear to put your hand inside. The operation then only took about three hours.

Seventy-two worms died before spinning, all from *Grasserie* or *Court*.

There was no sign of pebrine in any of the lots.

The following table gives the outturn of green cocoons:—

Lot. No.	Variety.	Number of Cocoons.	Weight of green cocoons.	Remarks.
1	2	3	4	5
			Srs. Ch. Tol.	
1	LocalVar.	3,017	6 4 4	The total amount of floss was 5 chittaks.
2	Imported Var.	5,43	13 12 0	
	Local Italian Yellow ...	5,013	12 0 4	

Fifty of the best cocoons of the Local Var. and the same number of the Local Italian Yellow were selected and kept for "seed." The remaining cocoons were dried in the oven as described above, when they lost about $\frac{2}{3}$ of their weight by drying.

Samples of the cocoons produced were sent to the Bengal Silk Company, Limited, Calcutta, who kindly furnished a valuation report from which the following extracts are taken:—

(1) *Var. from seed newly imported from France.*—These are good cocoons equal to the best of the samples received this year from Kashmir. They give silk rather pale in colour but of good quality.

(2) *Var. from seed raised at Shillong.*—These cocoons are not so good as the last, and if they were reared under favourable circumstances, I should recommend that this variety be discarded in favour of the following.

(3) *Italian Yellow, from seed raised in Shillong.*—These cocoons are of magnificent quality and gave silk of a beautiful yellow colour.

I value these cocoons as follnws and recommend their purchase at the prices given:—

(1) Rs. 2-12 per kahan of 1,280 cocoons.

(2) Rs. 2-4 „ „ „ 1,280 „

(3) Rs. 3-12 „ „ „ 1,280 „

Mulberry cultivation.

11. The area under mulberry at the Fruit Farm was extended by about $\frac{1}{10}$ acre during the year, the total area now being about 3 acres. There are also some 340 odd trees planted alongside the fences of the Farm.

Distribution of plants and seeds.

12. In the following table the numbers of plants, etc., distributed during the last three months only of the year under report are given, the rest of the records were destroyed when the Farm Superintendent's house was burnt down last spring. In addition to the plants enumerated below, several varieties of ornamental trees were distributed to the residents of Shillong.

Statement showing number of plants distributed during months of April, May and June 1908.

No.	Description.	No. or quantity distributed.	No. of persons supplied.		
			Khasis.	Others.	Total.
1	2	3	4	5	6
1	Asparagus plants ...	110	1	1	2
2	Rhubarb „	250	4	1	5
3	" seed	½oz.	...	1	1
4	Walnut plants	4	...	1	1
5	Fig cuttings	8	...	1	1
6	Spanish chestnut plants ...	21	2	2	4
7	Pear grafts	78	8	6	14
8	Apple „	14	4	2	6
9	Plum „	19	1	4	5
10	Peach „	63	5	7	12
11	Grape rooted cuttings ...	54	4	5	9
12	Mulberry rooted cuttings ...	6,892	2	1	3
13	Mountain papaya plants ...	14	3	2	5
14	Strawberry suckers	3,270	6	5	11
15	American sweet potato ...	1½ srs.	...	1	1
16	Khasi ditto ...	½ sr.	...	1	1
17	Tree tomato plants ...	22	4	1	5
18	Plane tree plants ...	11	...	2	2
19	Lemon grass oil ...	2oz	...	1	1
20	Sohiong plants ...	14	...	2	2
21	Poplar tree cuttings ...	1	...	1	1
	Total	...	44	48	92

Receipts and expenditure.

13. The total receipts for the year amounted to Rs. 470-11-3, as compared with Rs. 207-15-3 in the previous year.

The expenditure was Rs. 2,996-2-3, including Rs. 313-7, the cost of running a small nursery in Shillong. This does not include the salaries of the Farm Superintendent, fieldman clerk, and apprentices, as the Fruit Station is worked along with the Upper Shillong Farm, and these officers work on both the farms.

A. G. BIRT,

Offg. Assistant Director of Agriculture,
Eastern Bengal and Assam.

STATEMENT I.

Showing the number and description of fruit trees at the Fruit Station and the Upper Farm at the close of June 1908.

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
	Golden Reinette ...	England	September 1903 ...	...	1*	
			July 1904 ...	1*	...	
	Kerry Pippin ...	Ditto ...	Ditto ...	1*	...	
	Cox's Orange Pippin ...	Ditto ...	September 1903 ...	...	1*	
	Ribston Pippin ...	Ditto	Ditto ...	...	1*	
			July 1904 ...	...	1*	
	King of Pippins	Ditto ...	September 1903 ...	...	1*	
		Ditto ...	July 1904 ...	...	1*	
		Locally grafted ...	Do. 1906 ...	2	...	Planted under the wall.
	Scarlet Golden Pippin ...	England	September 1903 ...	...	1*	
			March 1903 ...	1	...	

Apple	Thomas Rivers	Ditto	July 1904	...	1*		
	Allington Pippin	Ditto	Ditto	1*	1*		
	Braddik's Nonpareil	Ditto	Ditto	...	1*		
	Manington's Pearmain	Ditto	Ditto	1*	1*		
	Devonshire Quarenden	Ditto	Ditto	...	1*		
	Newton Pippin	Saharanpur	March 1903	3	...		
	Blenheim Orange	Ditto	Ditto	3	...		
	Early Harvest	Ditto	Ditto	2	...		
		Locally grafted	January 1908	1	...		
	Freeman's Apple	Old Model Farm	About 30 years old	...	4	Called Freeman's Apple after the name of the Superintendent of the Old Model Farm.	
		Locally grafted	1898	...	1		
			Carried over	16	17		

N.B.—The trees marked with asterisks were transferred from the terraces in the Fruit Garden where they were planted in March 1903.

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
			Brought forward...	16	17	
	Freeman's Apple ...	Locally grafted ...	1901	...	6	
		Ditto ...	February 1906 ...	1	1	
		Ditto ...	March 1906 ...	1	...	
	White Apple ...	Ditto ...	„ 1907 ...	3	...	
		Ditto ...	January 1908 ...	2	...	
		Ditto ...	February 1908 ...	2	...	
			Total ...	25	24	

Besides, there were the following number of new grafts not yet planted in permanent stations.

Apple—*concld.*	Napoleon Bultern ...	Grafted ...	April 1908 ...	1	...
	Reinette Bonne Canada	Ditto ...	Ditto ...	6	...
		Budded ...	June 1908 ...	1	...
	Weips Winter Reinette...	Grafted ...	April 1908 ...	1	...
	King of the Pippins ...	Budded ...	June 1908 ...	11	...
	White Apple from Reesenrhode's.	Grafted ...	February 1906 ...	...	1
		Ditto ...	March 1907 ...	3	...
		Ditto ...	February 1908 ...	25	...
		Budded ...	June 1908 ...	4	...
	Freeman's Apple ...	Grafted ...	1902	...	6
			Total ...	51	7

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	1	3	4	5	6	7
	Souvenir du Congress ...	England ...	September 1903 ...	...	2*	
	Beurre D'Anmanlis ...	Ditto ...	March 1903 ...	1	...	
		Ditto ...	September 1903 ...	...	1*	
		Locally grafted ...	February 1905 ...	...	1	
	Williams Bonchretian ...	Ditto ...	„ 1908 ...	1	...	
	Claps Favourite ...	England ...	Ditto ...	...	2*	
	Doyenne du Comice	England	September 1903 ...	...	1	
			July 1904 ...	1*	...	
		Locally grafted ...	February 1908 ...	1	...	
	Marie Louise ...	Ditto	Ditto ...	2	1*	
			Ditto 1905 ...	...	2	
	Ditto ...	England ...	July 1904 ...	1*	...	

Pear ...	Duchess D'Angouleme ...	Ditto ...	Ditto ...	1*	1*	
	Conference ...	Ditto ...	Ditto ...	1*	1*	
		Locally grafted ...	March 1907 ...	2	...	
		Ditto ...	February 1905 ...	...	1	
	Louise Bonne of Jersey...	England ...	July 1904 ...	...	1*	
	Emile D'Heyat ...	Ditto ...	Ditto ...	...	1*	
		Locally grafted ...	February 1905 ...	...	3	
		Ditto ...	Ditto 1908 ...	3	...	
	LaConte	Saharanpur ...	March 1903 ...	3	...	
		Locally grafted ...	February 1908 ...	3	...	
	China	Saharanpur ...	March 1903 ...	3	...	
	Keiffer ...	Ditto ...	Ditto ...	3	...	
		Locally grafted ...	February 1905 ...	...	2	
		.....	Ditto 1908 ...	3	...	
	Kitchen Pear ...	Model Farm ...	30 years old ...	...	2	These have existed since the Old Model Farm.
	Unknown Pear ...	Locally grafted ...	1905	2	...	
			Carried over ...	30	21	

N.B.— The trees marked with asterisks were transferred from the terraces in the Fruit Garden where they were planted in March 1903.

STATEMENT I—*contd.*

Species of fruit tree.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
			Brought forward ...	30	21	
	Rossenrhode's Pear ...	Locally grafted ...	February 1906 ...	4	5	
	Ditto ...	Ditto ...	September 1906 ...	9	...	
	Ditto ...	Ditto ...	February 1907 ...	30	...	
	Ditto ...	Ditto ...	July 1907 ...	1	...	
	Ditto ...	Ditto ...	January 1908 ...	6	...	
	Ditto ...	Ditto ...	February 1908 ...	28	...	
			Total ...	108	26	

	Besides, there were the following grafts not yet planted out :—						
Pear—*contd* ...	Rossenrhode's Pear ...	Locally budded ...	June 1906 ...	...	25		
	Ditto ...	Ditto ...	July 1907 ...	33	...		
	Ditto ...	Ditto ...	June 1907 ...	...	4		
	Ditto ...	Locally grafted ...	September 1907 ...	...	21		
	Ditto ...	Ditto ...	October 1907 ...	71	14		
	Ditto ...	Locally budded ...	June 1908 ...	119	...		
	Conference	Ditto ...	Ditto ...	22	...		
	Marie Louise ...	Locally afted ...	January 1907 ...	3	...		
	Doyenne ducomice ...	Ditto ...	Ditto ...	3	...		
	LaConte	Ditto ...	October 1907 ...	8	...		
	Ditto	Ditto ...	February 1908 ...	12	...		
	Ditto	Locally budded ...	June 1908 ...	125	...		
	Keiffer	Locally grafted ...	October 1907 ...	60	...		
	Ditto	Ditto ...	September 1907 ...	...	1		
	Ditto	Ditto ...	February 1908 ...	11	...		
			Carried over ...	467	65		

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	
			Brought forward ...	467	65	
Pear—*concld.*	Keiffer	Locally budded ...	June 1908 ...	103	...	
	China	Locally grafted ...	February 1905 ...	1	...	
	Ditto	Ditto ...	October 1907 ...	35	...	
	Ditto	Budded ...	June 1908 ...	55	...	
	Ordinary	Grafted ...	June 1902 ...	11	...	
	Unknown	Ditto ...	September 1907 ...	...	5	
			Total ...	672	70	

Plum ...	Mallard	England ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	1	...	
	Czar	Ditto ...	March 1903 ...	1	...	
	Ditto	Ditto ...	September 1903 ...	...		1
	Ditto	Ditto ...	July 1904 ...	...		1
	Oullin's Golded Gage ...	Ditto ...	Ditto ...	1		1
	Jefferson	Ditto ...	Ditto ...	1		1
	Kirke	Ditto ...	Ditto ...	1		1
	White Magnum Bonum	Ditto ...	Ditto ...	...		1
	Golden Esperon ...	Ditto ...	Ditto ...	1		1
	Monarch	Ditto ...	Ditto ...	1		1
	Early Transperent Gage	Ditto ...	September 1903 ...	...		1
	Swan	Ditto ...	July 1904 ...	1		1
	Cox's Emperor ...	Ditto ...	Ditto ...	1		1
	Belgian Purple ...	Ditto ...	September 1903 ...	...		1
	Ditto	Ditto ...	July 1904 ...	1	...	
			Carried over ...	11	12	

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
			Brought forward ...	11	12	
Plum—*concld.*	Belgian Purple ...	Locally grafted ...	January 1908 ...	1	...	
	Early Rivers ...	England ...	March 1903 ...	1	...	
	Ditto ...	Ditto ...	September 1903 ...	...	1	
	Ditto ...	Ditto ...	July 1904 ...	1	...	
	Ditto ...	Locally grafted ...	March 1906 ...	1	...	
	Belle de Louvain ...	England ...	September 1903 ...	...	1	
	Ditto ...	Ditto ...	July 1904 ...	1	...	
	Blue Rock	Ditto ...	September 1903 ...	...	1	
	Ditto ...	Ditto ...	July 1904 ...	...	1	
	Sultan	Ditto ...	September 1903 ...	...	1	
	Ditto	Ditto ...	July 1904 ...	...	1	

Victoria	Ditto ...	Ditto ...	...	1
Curlew	Ditto ...	Ditto ...	...	1
Greengage	Ditto ...	September 1903 ...	...	1
Ditto	Ditto ...	July 1904 ...	...	1
Reine Claude ...	Ditto ...	September 1903 ...	...	1
Ditto ...	Ditto ...	July 1904 ...	...	1
Unknown	Ditto ...	March 1903 ...	1	...
Ditto	Ditto ...	July 1904 ...	1	1
Denniston Superb ...	Ditto ...	September 1903 ...	...	1
		Total ...	18	26

Besides, there were the following grafts waiting to be removed :—

Early Rivers ...	Grafted ...	September 1907 ...	17	...
Ditto ...	Budded ...	June 1908 ...	30	...
Mallard	Ditto ...	Ditto ...	21	...
Czar	Ditto ...	Ditto ...	10	...
Unknown	Ditto ...	Ditto ...	10	...
		Total ...	88	...

N. B.—Except those planted in March 1903 and the locally grafted Early Rivers, and Belgian varieties, the rest were transferred to their present stations from the terraces in the Fruit Garden where they were first planted in March 1903.

STATEMENT I—*contd.*

Species of trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Nectarine ...	Cabul ...	Saharanpur ...	December 1907 ...	6	...	
	Ditto	Locally budded ...	June 1908 ...	22	...	
	Besides there were the following grafts waiting to be removed :—					
Peach ...	Early Silver ...	England ...	March 1903 ...	2	...	
	Ditto	Ditto ...	September 1903 ...	...	1	
	Ditto	Locally grafted ...	1906	1	...	
	Noblesse	England ...	March 1903 ...	1	...	
	Dr. Hogg	Ditto ...	Ditto ...	2	...	
	Ditto	Locally grafted ...	1906	1	...	
	River Early York ...	England ...	March 1903 ...	1	...	
	Ditto	Ditto ...	September 1903 ...	...	1	
	Royal George ...	Ditto ...	Ditto	...	1	

China	Saharanpur ..	December 1907 ...	1	...
Duke of Wellington ...	Ditto ...	Ditto ...	1	...
Early Rivers ...	Ditto ...	Ditto ...	1	...
		Total ...	11	3

Besides, there were the following grafts locally made waiting to be transplanted :—

Peach ...	Early Silver ...	Locally grafted ...	September 1907 ...	17	...
	Ditto	Budded ...	June 1908 ...	68	...
	Dr. Hogg	Locally grafted ...	July 1907 ...	17	...
	Ditto	Ditto budded ...	June 1908 ...	61	...
	Noblesse	Ditto grafted ...	September 1907 ...	28	...
	Rivers Early York ...	Ditto ...	Ditto ...	10	...
	Ditto	Locally budded ...	June 1908 ...	15	...
			Total ...	216	...
Quince ...	Common	Saharanpur ...	December 1907 ...	2	...
	Ditto	Ditto ...	January 1908 ...	6	...
			Total ...	8	...

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
	Flemish Red ...	England ...	March 1903 ...	1	...	The trees planted in September 1903 and July 1904 were transferred from the terraces in the Fruit Garden, where they were first planted in March 1903.
	Ditto	Ditto ...	September 1903 ...	...	1	
	Early River's Black ...	Ditto ...	March 1903 ...	1	...	
	May Duke ...	Ditto ...	Ditto ...	1	...	
	Ditto	Ditto ...	July 1904 ...	1	...	
	Royal Duke ...	Ditto ...	March 1903 ...	2	...	
	Ditto	Ditto ...	July 1904 ...	1	...	
	Giant D'Heidel Finger...	Ditto ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	2	...	

Cherry ...	Kent Bigarreau ...	Ditto ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	1	...	
	Napoleon	Ditto ...	March 1903	1	...	
	Ditto	Ditto ...	July 1904 ...	1	...	
	Black Eagle ...	Ditto ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ..	1	...	
	St. Margarets ...	Ditto ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	1		1
	Emperor Francis ...	Ditto ...	Ditto ...	1		1
	Early Elton ...	Ditto ...	Ditto ...	1		1
	Ditto	Ditto ...	September 1903 ...	2		1
	Cleveland Begarreau ...	Ditto ...	July 1904 ...	1	...	
	Guigne D'Winkler ...	Ditto ...	Ditto ...	2	...	
	Governor Wood ...	Ditto ...	Ditto ...	1		1
			Total	26		6

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
			Brought forward ...	26	6	
Cherry—concld.	Black Tartarian ...	England ...	September 1903 ...	...	1	
	Ditto	Ditto ...	July 1904 ...	1	1	
	Florence ...	Ditto ...	September 1903 ...	...	1	
	Ditto	Ditto ...	July 1904 ...	...	1	
			Total ...	27	10	
Apricot ...	Royal	England	June 1903 ...	1	...	
	Oullin's Early Peach ...	Ditto ...	Ditto ...	1	...	
	Blenheim ...	Ditto ...	September 1903 ...	...	1	Transferred from Fruit Garden.
	New Large Early ...	Saharanpur ...	December 1907 ...	3	...	
	Cashmere ...	Ditto ...	Ditto ...	3	...	
			Total ...	8	1	

Besides, there were the following grafts waiting to be transplanted :—

	Oullin's Early Peach ...	Grafted ...	June 1908 ...	26	...	
	Royal	Ditto ...	Ditto ...	13	...	
			Total ...	39	...	
Almond ...	Amandier Comunis. ...	England ...	February 1904 ...	3	...	
	Ditto	Ditto ...	March 1904 ...	...		1
	Thin Shell ...	Ditto ...	February 1904 ...	1	...	
			Total ...	4		1
Walnut ...	Kashmere ...	Kashmir (grown from seed) ...	Summer 1905 ...	12		6

Besides, there were two 4 years' old trees in the nursery at the Fruit Garden.

Fig ...	Brunswick ...	Local cuttings ...	July 1905 ...	3	...	
	Ditto	Ditto ...	August 1905 ...	2	...	
	Ditto	Ditto ...	September 1906 ...	1	...	
	Ditto	Ditto ...	March 1907 ...	5	...	
	Violette Sepor ...	Ditto ...	June 1906 ...	2	...	
			Carried over ...	13	...	

STATEMENT I—*contd.*

Species of fruit trees.	Variety	Whence obtained	When planted	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
			Brought forward ...	13	...	
	Violette Sepor ...	Local cuttings ...	September 1906 ...	4	...	
	Ditto ...	Ditto ...	March 1907 ...	2	...	
	Bourjasotte Noire ...	Ditto ...	June 1906 ...	3	...	
	Ditto ...	Ditto ...	September 1906 ...	1	...	
	Bourjasotte Grise ...	Ditto ...	September 1906 ...	1	...	
	Figue D'or ...	Ditto ...	August 1905 ...	2	...	
	Ditto ...	Ditto ...	June 1903 ...	1	1	
	Ditto ...	Ditto ...	September 1906 ...	1	...	
	Ditto ...	Ditto ...	March 1907 ...	2	...	

Fig—concld. ...	St. John ...	Local cuttings ...	September 1906 ...	4	...
	Ditto ...	Ditto ...	March 1907 ...	1	...
	Pingo De Mel ...	Ditto ...	March 1907 ...	1	...
	Black Ischia ...	England ...	November 1903 ...	1	...
	Ditto ...	Local cuttings ...	March 1907 ...	1	...
	White Marseilles ...	Ditto ...	August 1905 ...	1	...
	Ditto ...	Ditto ...	June 1906 ...	1	...
	Ditto ...	Ditto ...	September 1906 ...	2	...
	Ditto ...	*Ditto* ...	March 1907 ...	1	...
	Colonel De Signora ...	England ...	,, 1903 ...	1	...
	Brown Turkey ...	Local cuttings ...	August 1905 ...	3	2
	Poona ...	Poona ...	March 1907 ...	4	...
			Total ...	51	3

N.B.—Besides, there was one rooted cutting waiting to be transplanted. The cutting was made in the autumn of 1906.

	Black Ischia ...	... ..	.....	1	...

STATEMENT I—*contd.*

Species of fruit trees.	Variety	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit station.	Upper Farm.	
1	2	3	4	5	6	7
	English No. 1 ...	Local cutting ...	June 1904 ...	1	1	*Nos. 1, 2, 3, and 5,* name not known owing to loss of labels.
		England ...	March 1907 ...	1*	...	
	„ No. 2 ...	Ditto ...	January 1908 ...	1*	...	
		Local cutting ...	Ditto ...	1*	...	
	„ No. 3 ...	England ...	July 1903 ...	1*	...	
		Local cutting ...	March 1904	...	2	
	„ No. 4 (Golden Queen).	England ...	January 1908 ...	1*	...	
		Local cutting ...	1904	1	2	
		Ditto ...	1905	1	...	
		Ditto ...	January 1908 ...	2*	...	
	„ No. 5	Ditto ...	Ditto ...	3*	7	
		England ...	March 1907 ...	1*	...	
	„ No. 6 (Lady Downe's seedling).	Ditto ...	January 1908 ...	1*	...	

Grape ...	Local Black ...	Local cutting ... From a vine in the Roman Catholic Mission compound.	1904 ...	4	11	
	Ditto	Ditto ...	1905 ...	1	...	
	Ditto	Ditto ...	1906	1	...	
	Ditto ...	Ditto ...	February 1907 ...	1*	...	
	Ditto ...	Ditto ...	January 1908 ...	1*	...	
	Merlot	Cuttings obtained from Kashmir in 1903.	March 1906 ...	3	...	
	Ditto	Ditto ...	February 1907 ...	13	...	
	Cabernet Sauvignon ...	Ditto ...	March 1906 ...	1	...	
	Ditto ...	Ditto ...	February 1907 ...	13	...	
	Malbeck wine ...	Ditto ...	March 1906 ...	2	...	

* The vines marked with asterisks were removed from the plant-house and from the stable to terraces in the Fruit Field in March 1907 and January 1908.

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	Whence planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
	Malbeck wine ...	Cuttings obtained from Kashmir in 1903.	February 1907 ...	5	...	
	Sanvignon Santern ...	Ditto ...	March 1906 ...	2	...	
	Ditto ...	Ditto ...	February 1907 ...	14	...	
	Semiton Santern ...	Ditto ...	March 1906 ...	3	...	
	Ditto ...	Ditto ...	February 1907 ...	11	...	
	Cabernet	Ditto ...	March 1906 ...	4	...	
	Ditto	Ditto ...	February 1907 ...	12	...	
	Hosseini Cabuli ...	Ditto ...	June 1906 ...	1	...	
	Chassellas	Ditto ...	February 1907 ...	10	...	
	Manjuren (wild grape) ...	Local ...	January 1908 ...	1	...	
			Total ...	118	23	

N.B.—Besides, there were the following number of rooted cuttings awaiting removal to permanent sites :—

	English No, 1 ...	.....	.....	3	...
	Ditto No. 3 ...	.....	.....	22	...
	Ditto No. 4 (Golden Queen).	.....	.....	2	...
	Black	.....	.....	83	...
	Kashmir	.....	.....	95	...
			Total ...	205	...
Spanish chestnut.	Spanish chestnut ...	Legacy from former Model Farm about 30 years old.	.....	...	54
	Ditto	Saharanpur	*June* 1903 ...	21	...
			Total ...	21	54

N. B.—Besides, there were 145 seedlings grown locally from seed sown in 1906.

Chorimoyer ...	... ...	From seed obtained from the Southern Shan States.	1904	5	...
			1906	1	...
			Total ...	6	...

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit station.	Upper Farm	
1	2	3	4	5	6	7
Tree Tomato ...	.....	From seed obtained from Ceylon.	1904	1	...	
			July 1907 ...	65	...	
			Total	66	...	
N.B.—Besides, there were 63 seedlings grown locally from seed.						
Mountain Papaya	.....	From seed obtained from Ceylon.	1904	13	...	
		Ditto ...	1906	8	...	
			Total	21	...	
N.B.—Besides, there were 47 seedlings grown locally from seed produced at the Fruit Garden.						
Loquat ...	.....	From cuttings taken from trees in the Station.	1903	3	...	

Guava ...	Smooth, green ...	Saharanpur ...	1905 ...	1	...
	Ditto	Local layerings ...	1907 ...	2	...
	Cattleya	Saharanpur ...	1905 ...	1	...
	Guineusis	Ditto ...	1905 ...	1	...
			Total	5	...
Khasi *orange* and citron ...		Local	1904 & 1905 ...	105	...
	Besides there was one *orange* budder on citern waiting to be transplanted.				
Raspberry ...	Superlative ...	Suckers from plants received from England in 1903	...	3	...
	White Antwerp ...	England, 1906 ...	March 1907 ...	6	...
	Bunyard Superlative ...	Ditto ...	Ditto ...	3	...
			Total ...	11	...

N.B.—Besides, there were 18 plants in the plant-house waiting to be removed to the field.

STATEMENT I—*concld.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Gooseberry ...	Early Sulphur ...	England ...	September 1903 ...	...	1	
	White Smith ...	Ditto ...	Ditto ...	...	1	
			July 1904 ...	...	1	
	Crown Bob ...	Ditto ...	September 1903 ...	...		
			July 1904 ...	1	...	
	Lancashire Lad ...	Ditto ...	Ditto ...	...	1	
	Hedgehog ...	Ditto ...	July 1904 ...	...	1	
	Winham's Industry ...	Ditto ...	Ditto ...	...	1	
			Total ...	1	7	

Currant ...	Baldwin's Black ...	England ...	September 1903 ...	...	2
	Ditto	Ditto ...	July 1904 ...	1	1
	Red Dutch... ...	Ditto ...	September 1903 ...	...	1
	Ditto	Ditto ...	July 1904 ...	...	1
	Red Scotch... ...	Ditto ...	September 1903 ...	...	2
	Ditto	Ditto ...	July 1904 ...	2	4
	Boskop Black ...	Ditto ...	September 1903 ...	...	2
	Ditto	Ditto ...	July 1904 ...	...	2
	White Versailles ...	Ditto	September 1903 ...	...	2
	Ditto	Ditto ...	July 1904 ...	1	...
	Ditto	Ditto ...	March 1907 ...	5	...
	Ditto	Local cuttings ...	June 1906 ...	5	...
	White Dutch ...	England ...	September 1903 ...	...	1
	Ditto	Ditto ...	July 1904 ...	1	2
	Red Utretch ...	Ditto ...	September 1903 ...	...	2
	Ditto	Ditto ...	July 1904 ...	...	1
			Total ...	15	23

STATEMENT II

Showing the number and description of fruit stocks at the Farm and Fruit Garden on 30th June 1908.

—	At the Fruit Garden.	At the Farm.	Total.
1	2	3	4
Sohshur (wild pear)	494	1,769	2,263
Sohphoh (wild apple)	32	1,049	1,081
Sohi ng (Khasi cherry)	221	...	221
Plum	174	607	781
Peach	113	...	113
Fig (wild Khasi)	7	...	7
Manjuren (wild grape)	5	...	5
Total ...	1,046	3,425	4,471

Annual Report of the Upper Shillong Agricultural Station for the year ending the 30th June 1908.

Introductory.

Since 1903, this Farm has been managed as a joint concern with the Fruit Experiment Station. The main work at the Fruit Station has been the cultivation of fruit trees imported from the temperate climates of Europe, but part of this work is carried on at the Upper Station, to which many of the fruit trees were transferred in 1903 and 1904 with a view to test the effects of a higher elevation on their growth. On the other hand, the cultivation of potatoes, which has been one of the chief items of work on the pragramme of the Upper Station, has to be carried on partly at the Fruit Station for want of suitable land at the Upper Station. Although managed as a joint concern, the accounts of the two stations are kept separate.

History and description.

2. The Upper Shillong Station was established in the year 1897-98. It is situated on the Cherrapunji road, 5½ miles from the town of Shillong, and ocupies the site of the old "Model Farm" which ceased to exist in 1879. The elevation of the Station is 5,900 feet, *i.e.*, about 900 feet higher than Shillong town. The boundaries have been surveyed and 8 boundary pillars erected. A large area of pine forest was annexed to the Station in 1905. The cultivated area is divided into a number of separate fields having an aggregate area of about eleven acres. All the fields but one lie on the slopes of a long narrow valley, the bottom of which consists for the most part of marshy land, covered with a thick growth of wild grass. The forest is of use as a source of timber, a large quantity of which is annually required for fencing and building on the Station.

The soil of the greater part of the Station is a coarse reddish loam of very loose texture, which can be worked with

the greatest ease. The sub-soil is of a more pronounced reddish colour and of great depth. In a small portion of the Station the soil is black owing, it is believed to the existence of some mineral compound. The soils have not been analysed. In point of quality, they are extremely poor, and very little can be grown on them without the help of manure. The soil at the bottom of the valley is very different from either of the above. It is a dark clay or clayey loam, extremely rich in organic matter. Having been under a thick growth of grass for many years, the upper portion of the soil is a matted mass of half decayed grass roots. The valley has not yet been properly drained. Some work in this direction was done during 1906-1907, but as yet this land is not fit for cultivation and is useful only as a pasture ground. A small portion of the drained area has been reclaimed and placed under cultivation. It is proposed to drain a further area and bring it under cultivation next year.

Besides the natural poverty of the soil, the greater portion of the Station suffers from the disadvantages of an exposed situation. It is colder and more windy than Shillong; frosts are of very common occurrence during the winter, and more severe than in the town. During winter the growth of vegetation is wholly suspended.

The main objects with which the Station was established, were the introduction of superior varieties of potato, which is the most important staple grown on the higher plateau of the Khasi Hills, the cultivation of fodder crops and the preservation of fodder in silos for use in the winter when natural fodder becomes extremely scarce, and the encouragement of fruit cultivation. These objects are still kept in view. New items of work have from time to time been added to the programme of the Farm. Among these, the most important is the breeding of improved strains of cattle with a view to their introduction in the district.

Weather.

3. The year under report covers the latter part of the monsoon of 1907, the winter of 1907-1908 and the spring and early monsoon of 1908. It thus includes part of two growing seasons.

The weather was quite normal in the latter half of 1907, but the months of March and April 1908 were unusually dry and this had a bad effect on the germination of potatoes and other crops.

Work done during the year.

4. The work of the year included—

(1) Experiments with potatoes ;

(2) making of silage ;

(3) cattle-breeding ;

(4) cultivation of fruit trees ;

(5) demonstrations on the holdings of Khasi cultivators in the neighbourhood of the Farm.

The cultivation of fruit trees is dealt with in the annual report of the fruit station, as it is more convenient to consolidate the fruit experiments in one report.

Potato experiments.

5. These fall under the followings headings—

(1) variety tests;

(2) spraying trials with Bordeaux mixture as a prevention of disease ;

(3) manurial trials—oilcake *versus* mineral manures ;

(4) whole *versus* cut sets ;

(5) large whole sets *versus* small whole sets ;

(6) whole sets *versus* sets with a small part cut off, (the Khasi practice is to cut all their sets whether large or small) ;

(7) manuring experiment with green manure *versus* cowdung. (This experiment was made at the Fruit Station).

Variety tests with potatoes.

6. Sixteen varieties were compared, of these eleven have been grown on the Farm for several years, while of the remainder, Magnum Bonum was obtained direct from Sutton's, England, New Nainital from Nainital, and Sindur Khatua, Silbilati and Darjeeling from the Rangpur Farm.

The seed of the eleven varieties was the produce of a second crop grown on the Farm in the autumn of 1907.

The crop was planted from 20th to 21th February and was manured with 800 baskets of cowdung (300 maunds) and 20 maunds of rape cake per acre. The experiment was made on duplicate plots, each $\frac{1}{160}$ acre in area.

The following table gives the yield of each variety :—

No.	Variety.	Series I.		Series II.		Average of duplicate plots per acre.
		Yield per plot.	Yield per acre.	Yield per plot.	Yield per acre.	
1	2	3	4	5	6	7
		Mds. s.	Mds.	Mds. s.	Mds.	Mds.
1	Northern Star	0 33	132	1 1	164	148
2	King Edward VII	1 7	168	1 5	150	154
3	King of Potatoes	1 9	196	1 27	303	252
4	Nilgiri	0 33	132	1 9½	198	165
5	Earliest of all	0 29	116	1 0	160	138
6	Empress	1 5	150	0 24	136	138
7	Good Hope	1 6	154	0 24	136	160
8	Norcton Beauty	0 24½	98	0 12	48	73
9	Eldorado	1 7	188	1 9½	199	193½
10	Sutton's Magnum Bonum ...	0 37	148	1 0	160	154
11	Nainital	1 16	224	1 20	240	232
12	Khasi round	1 11½	207	1 22	248	227½

Magnum Bonum from seed raised at the Farm gave an average of 196 maunds per acre, but is not included in the table, as through some misunderstanding it was manured with a complete mixture of mineral manures, *viz.*, superphosphate 6 maunds, saltpetre 2½ maunds and sulphate of potash 1 maund instead of oilcake.

The Darjeeling, Sil Biliati and Sindur Khatua varieties gave such miserable yields, in each case considerably less than the weight planted, that it is not thought worthwhile to include them in the table.

A special test of 6 varieties was also made on duplicate plots, each $\frac{1}{80}$ acre in area. All the plots received 300 maunds of cowdung and 20 maunds rape cake per acre.

The results are given below :—

No.	Variety.	Series I.		Series II.		Average of duplicate plots per acre.
		Yield per plot.	Yield per acre.	Yield per plot.	Yield per Acre.	
1	2	3	4	5	6	7
		Mds. s.	Mds.	Mds. s.	Mds.	Mds.
1	Farm Magnum Bonum ...	8 25	290	3 12	264	277
2	King Edward VII	3 7½	254½	3 21½	283½	269
3	King of Potatoes	3 34	304	4 7	354	329
4	Sutton's Magnum Bonum ...	2 9½	179	1 38	156	167½
5	Nainital	4 0	320	3 13	264	292
6	Khasi round	3 26	292	2 29	218	255

To get some idea as to the percentage of sound tubers at the time of harvesting them, ten large, ten medium sized and ten small tubers of each variety were selected haphazard, cut open, and examined for signs of disease. The percentage of tubers of each variety found to be diseased was as follows :—

Serial No.	Variety.	Large.	Medium.	Small.
1	2	3	4	5
1	Northern Star ...	*Nil.*	*Nil.*	*Nil.*
2	Good Hope	10	*Nil.*	*Nil.*
3	Earliest of all ...	*Nil.*	*Nil.*	*Nil.*
4	Norton Beauty ...	10	*Nil.*	*Nil.*
5	Nainital	30	20	10
6	Eldorado	20	30	10
7	Empress	20	20	20
8	Nilgiri	20	50	10
9	Khasi round ...	20	*Nil.*	*Nil.*
10	King of potatoes ...	*Nil.*	*Nil.*	*Nil.*
11	Farm Magnum Bonum...	*Nil.*	10	10
12	Sutton's Magnum Bonum	10	10	*Nil.*
13	King Edward VII ...	20	*Nil.*	*Nil.*

King of Potatoes came out top in both the variety tests and was also free from disease. Other varieties which gave good yields are Nainital, Khasi round, Eldorado, King Edward VII and Farm Magnum Bonum.

Nilgiri, Nainital, Eldorado and Empress were the varieties most badly attacked by disease.

It is proposed to reject all varieties which fall below 150 maunds per acre in yield and at the same time are not disease-resisting, and to test the remaining varieties on larger plots next season.

Spraying with Bordeaux Mixture.

7. These experiments have now been carried out for four years. The results obtained this year confirm those of the past three years.

Two experiments were made—

(*a*) *To test the effect of spraying with* :—

1. Ordinary Bordeaux Mixture.
2. Ditto *plus* resin and soda.
3. Ditto „ *gur*.

In this experiment eight plots each $\frac{1}{80}$ acre in area of Magnum Bonum potatoes were taken.

These were divided into two series of four plots each and the experiment was done in duplicate.

The first plot received plain Bordeaux Mixture, the second Bordeaux mixture to which a small quantity of resin and soda was added, the third Bordeaux Mixture to which *gur* was added and the fourth was untreated.

The object of mixing the resin and soda and the *gur* with the Bordeaux Mixture was to make it adhesive.

The plots were sprayed 3 times with a total of 300 gallons per acre of mixture. A dose of 60 gallons per acre was given in the last week of April when the plants were young, a second dose of 120 gallons per acre in the second week in May, and the third dose of 120 gallons per acre in the beginning of June.

The composition and cost of the mixtures is given below :—

Plain Bordeaux Mixture : 300 *gallons*.

	Rs.	a.	p.
Sulphate of copper 18¾ seers at Re. 1 ...	18	12	0
Lime ⅔ths of above = 14 seers 1 chattak at 1 anna per seer	0	14	0
Water 300 gallons	...		
Total ...	19	10	0

		a.	p.
Labour for preparing mixture and spraying (wages of 6 men at 6 annas) ...	2	4	0
Total ...	21	14	0

Bordeaux Mixture with Resin and Soda: 300 *gallons.*

	Rs.	a.	p.
Plain Bordeaux Mixture, 300 gallons ...	19	10	0
One hundred pints of resin-soda solution, containing rosin 6¼ seers at Re. 1 ...	6	4	0
Soda 3⅛ seers at 8 annas ...	1	9	0
Total ...	27	7	0
Labour for preparation and application (wages of 7 men at 6 annas) ...	2	10	0
Total ...	30	1	0

Bordeaux Mixture with gur: 300 *gallons.*

	Rs.	a.	p.
Plain Bordeaux mixture, 300 gallons ...	19	10	0
Gur (same quantity as lime, *viz.*, 14 seers 1 chattak at 4 annas per seer)	3	8	3
Total ...	23	2	3
Labour for preparation and application (wages of 6 men at 6 annas) ...	2	4	0
Total ...	25	6	3

N.B.—The resin and soda solution is prepared by boiling ¼ seer of resin and ¼ seer of washing soda in a gallon or 5 seers of water, till dissolved, adding water during boiling and at the end to keep up the full gallon. One pint or 10 chattaks of the solution is added to every 3 gallons of the Bordeaux mixture.

The results of the experiment are tabulated below :—

No. of plot.	Treatment.	1st Series.		2nd Series.		Average.
		Per plot $\frac{1}{80}$ acre.	Per acre.	Per plot $\frac{1}{80}$ acre.	Per acre.	Per acre.
1	2	3	4	5	6	7
		Mds. srs.	Mds.	Mds. srs.	Mds.	Mds.
1	Plain Bordeaux mixture ...	3 5½	251	3 10	260	255½
2	Bordeaux mixture *plus* resin-soda.	2 30½	220½	3 5	250	235½
3	Bordeaux mixture *plus gur* ...	2 33	236	3 12	264	250
4	Unsprayed	2 3	166	2 33	236	201

As in previous years the use of plain Bordeaux mixture has increased the yield considerably. When resin and soda or *gur* was used in the Bordeaux mixture the increase was not so great. This was also the case last year, the assumption being that the resin and soda and the *gur* when mixed with the Bordeaux mixture have some injurious effect on the plant.

The plain Bordeaux mixture having been applied in dry weather was in no danger of being washed off by rain and thus had the desired effect of checking the disease.

In showery weather the Bordeaux mixture with resin and soda or *gur* added would probably be more effective, as it would not be so readily washed off the leaves by showers of rain.

The financial results of the experiment are given below :—

No. of plot.	Treatment.	Average yield per acre.	Increase over unsprayed plot.	Value of increase at Rs. 2 per maund.	Cost of spraying per acre.	Profit per acre due to spraying.
1	2	3	4	5	6	7
		Mds.	Mds.	Rs.	Rs. a. p.	Rs. a. p.
1	Plain Bordeaux Mixture ...	255½	54½	109	21 14 0	87 2 0
2	Bordeaux Mixture + resin — Soda.	235½	34½	68½	30 1 0	38 7 0
3	Bordeaux Mixture + gur ...	250	49	98	25 6 3	72 9 9
4	Unsprayed	201	...	...	...	...

In the previous year the profit per acre from spraying with plain Bordeaux mixture was Rs. 88-2-0 which is practically the same as the figure for this year. In neither year was the disease very virulent, but the results shew that a very handsome profit is obtained from the use of Bordeaux mixture.

(*b*) *To test the effect of spraying once, twice and thrice.*

Eight plots of Magnum Bonum potatoes each $\frac{1}{80}$ acre in area, were taken for this experiment. These were divided into two series of 4 plots each and the experiment was done in duplicate.

The first plot was sprayed three times, once in the last week of April with 60 gallons of Bordeaux mixture per acre, again in the middle of May with 120 gallons per acre, and the third time in the beginning of June with 120 gallons per acre. The second plot was sprayed twice, once with 60 gallons in the middle of May and again with 120 gallons in the beginning of June.

The third plot was sprayed once in the beginning of June with 120 gallons per acre.

The results of the experiment are given in the following tables.

Yield of potatoes.

No. of plot.	Treatment.	Total quantity of Bord eaux Mixture.	1st series.		2nd series.		Average per acre.
			Per plot.	Per acre.	Per plot.	Per acre.	
1	2	3	4	5	6	7	8
		Gals.	Mds. srs.	Mds.	Mds. srs.	Mds.	Mds.
1	Sprayed 3 times ...	300	2 9	178	2 20	200	189
2	„ twice	180	2 7½	175	2 13	186	180½
3	„ once	120	2 4	168	2 10	180	174
4	Unsprayed	...	2 2	164	2 0½	172½	168½

Financial Results.

No. of plot.	Average yield per acre.	Excess yield over unsprayed plot.	Value of excess at Rs. 2 per maund.		Cost of spraying per acre.		Profit per acre due to spraying.	
1	2	3	4		5		6	
	Mds.	Mds.	Rs	as.	Rs	as.	Rs.	as.
1	139	20¾	41	8	21	14	19	10
2	130½	12½	24	8	13	2	11	6
3	117¼	5½	11	8	8	12	2	12
4	168¼	...	.....		.....		.....	

Compared with the results obtained in a similar experiment last year these results are disappointing.

On that occasion there was a profit of Rs. 173 per acre from spraying three times, Rs. 105 from spraying twice, and Rs. 59 from spraying once. But it should be mentioned that the yields then obtained on all the plots including the unsprayed ones were much larger.

Oilcake *versus* mineral manures for potatoes.

8. This experiment was designed to test the effect of oil cake in large and moderately large quantities against a complete dressing of mineral manures for potatoes.

The experiment was carried out in duplicate plots each $\frac{1}{80}$ acre in area. All the plots first received a dressing of 150 maunds of cowdung per acre.

The results on the duplicate plot are given in the table below together with the averages.

No. of Plot.	Manure per acre.	Series 1, yield of potatoes.			Series 2, yield of potatoes.			Average.
		Per plot.		Per acre	Per plot.		Per acre.	Per acre.
1	2	3		4	5		6	7
		Mds.	srs.	Mds.	Mds.	srs.	Mds.	Mds.
1	Rape cake 20 mds.	2	31	222	3	4	248	235
2	Ditto 10 mds.	2	28	216	2	35	230	223
3	Superphosphate 6 Mds. Sulphate of potash 1 Md. Saltpetre 2½ Mds.	3	0	240	2	31	262	251

The prices of the manures per maund delivered in Shillong were—rape cake Rs. 3-8, superphsophate Rs. 6, sulphate of potash Rs. 11, and saltpetre Rs. 11; thus the cost of manure per acre on plot 1 was Rs. 70, on plot 2 Rs. 35, and on plot 3 Rs. 74½.

The results seem to indicate that although the actual yield is lower on the plot receiving the smaller dressing of oil cake, yet, at the average price (Rs. 2 per maund) of potatoes in the Khasi Hills, the smaller dressing is more profitable than either the larger dressing of oil cake or the complete dressing of mineral manures on plot 3.

However, as this is the result of only one year's experiment, no definite conclusions can be drawn, especially as the differences between the yields per plot are so small that they may be accounted for by experimental error.

This experiment will be repeated next year with the addition of an unmanured plot as a control.

Whole *versus* cut sets.

9. This experiment was designed to test whether there is any disadvantage in using cut tubers as sets.

Four plots, each $\frac{1}{40}$ acre in area, were planted with Magnum Bonum potatoes, several years acclimatized in the Khasi Hills. The odd numbered plots were planted with whole medium sized tubers and the even numbered plots with cut sets.

The cut sets were obtained from large tubers by dividing them into two pieces, care being taken that each of the pieces had one or more "eyes".

The number of sets in each plot was the same and as near as possible the total weights of sets in each plot were equal.

The results of the experiment are given in the following table:—

Plot No.	——	Yield per plot.	Yield per acre.	Average of duplicate plots per acre.	
				Whole sets.	Cut sets.
1	2	3	4	5	6
		Mds. srs.	Mds.	Mds.	Mds.
1.	Whole sets	5 35	236		
2.	Cut „	5 21	221		
				2.2	213
3.	Whole „	4 29	189		
4.	Cut „	5 5	205		

The results are of little value, as the duplicate plots contradict each other while the average yield from cut sets is practically the same as that from whole sets.

This Experiment will be repeated next year with larger plots.

Large whole sets *versus* small whole sets.

10. This experiment was tried in duplicate on three plots of $\frac{1}{40}$ acre each.

The variety of potato was Magnum Bonum and the sets were dibbled into the ground.

In the first plot two large tubers were planted in each hole, in the second plot two small tubers in each hole, and in the third plot one large tuber in each hole.

The weight of seed planted and the yields obtained are given below—

No. of plot.	Weight of seed per plot.	Yield per plot.	Yield per acre.	Duplicate.		Average yield per acre.
				Yield per plot.	Yield per acre.	
1		3	4	5	6	7
	Srs.	Mds. srs.	Mds.	Mds. srs.	Mds.	Mds.
1	32	7 3	283	6 13	253	268
2	6	4 14	174	4 4	164	169
3	16	4 37	197	5 12	212	204½

Whole sets *versus* sets cut in local way.

11. It is the general practice in the Khasi Hills to cut a small portion from each tubes before planting. Tubers cut in this manner are said to germinate better than whole tubers and also to give a heavier crop. In order to test whether there are any grounds for this general belief four plots each $\frac{1}{80}$ acre in area were planted with Magnum Bonum potatoes. In two of the plots whole tubers were planted, while in the other two plots tubers from which a small portion had been cut away were planted.

The results were slightly in favour of the cut tubers, the yields per acre being 224 and 222 maunds against 212 and 206 maunds from the whole tubers.

Green manure *versus* cowdung.

12. This experiment was carried out at the Fruit Station, Shillong.

Nine plots each $\frac{1}{10}$ acre in area were taken.

The odd numbered plots were sown with Soybeans in May and the crop was ploughed in in September.

All the plots were planted with potatoes in March, the even numbered plots receiving 150 maunds of cowdung per acre at the time of planting.

The following table gives the results of the experiment.

Plot.	Treatment.	Yield.	
		Per plot.	Per acre.
1	2	3	4
		Mds. srs.	Mds.
1	Green manure	0 39½	39½
2	Cowdung	3 7	127
3	Green manure	0 30½	30½
4	Cowdung	2 9	89
5	Green manure	0 25½	25½
6	Cowdung	2 2½	82½
7	Green manure	19½	19½
8	Cowdung	1 37½	77½
9	Green manure	0 21½	21½
	Average of green manure plots ...	0 27⅓	27⅓
	Average of cowdung plots	2 14	94

All the plots gave a poor crop. The results on the green manure plots are miserable, the average outturn being less than one-third that of the cowdung plots.

It would have been more interesting if there had been an unmanured plot.

Silage.

13. As in previous years the four silos on the Farm were filled with green maize, Jobs'-tears and jungle grass in September. The total amount of green stuff put into the silos was 1,074 maunds, of which 645 maunds (60 per cent.) was recovered as good silage and fed to the cattle during the winter, 302 maunds (28 per cent.) was unfit for use, while the remaining 12 per cent. represents loss in the silo due to fermentation and drying.

These results are more satisfactory than those of last year when only 40 per cent. of the total quantity ensiled was recovered as good silage.

The total cost of good-silage per maund came to 9 annas 5 pies against 10 annas 6 pies per maund last year.

Cattle.

14. The following table gives a list of the cattle on the Farm at the close of the year.

	Patna.	Bhutia.	Patna × Bhutia.	Patna × Patna Bhuria cross.	Khasi.	Patna × Khasi.	Patna × Patna Khasi cross.	Total.
1	2	3	4	5	6	7	8	9
Bull	1	...	...	...	...	...	...	1
Cows	11	2	1	...	8	4	...	26
Young Bulls	4	...	...	...	...	6	...	10
Heifers	9	...	2	...	...	14	...	25
Bull calves	3	...	...	...	...	6	1	13
Heifer calves	4	...	1	1	...	5	2	13
Totals	32	3	4	1	8	37	3	87

There is also one pair of cart bullocks.

The local Khasi breed of cattle are poor milkers and from every point of view are extremely inferior type of animal.

The Patna cattle were introduced with the object of

improving the local breed for milking purposes.

The Bhutia cows were introduced as being somewhat similar to the Khasi breed but of a better type.

The Patna-Khasi cross is a decided improvement on the local breed, both as regards milking qualities and general appearance.

We have therefore decided to confine our attention to the breeding of pure Patna bulls for distribution. An endeavour will be made to induce the local cultivators to castrate their Khasi bulls and use Patna bulls instead.

Milking records of all cows on the Farm are being kept and only bulls out of good milking cows and by sires of good milking strains will be sent out from the Farm.

In addition to this all cows which are poor milkers will be weeded out from the herd.

During the year five young Patna bulls were sold to local cultivators at Rs. 10 each. The price was fixed extremely low in order to encourage the introduction of Patna blood.

In addition to the bulls the following cows were sold at prices ranging from Rs. 35 to Rs. 50 per head—

1 Patna cow.

1 Patna × Khasi cow.

11 Khasi cows.

Requisitions for Patna heifers are often received, but at present we require all we produce to build up the herd. Since the close of the year two more Patna bulls have been obtained for the herd and the old bull has been removed and allowed to leave cows brought in by local cultivators.

The total cost of maintaining the herd during the year was Rs. 3,242 as against Rs. 2,182 in the preceding year.

Details are given below :—

	Mds.	srs.	ch.	Rs.	a.	p.
Oilcake	229	15	2	886	7	0
Matikalai	134	19	12	769	12	5
Salt	9	15	5	40	3	9
Grass	2,021	11	0	490	2	1
Rice	5	3	0	30	7	2

Value of Farm produce.

	Mds.	srs.	ch.	Rs.	a.	p.
Silage	645	36	0	378	9	1
Sweet potatoes	176	36	0	133	2	6
Milk for calves	1	34	8	9	5	4
Wages of 4 cowmen ...		...		501	0	0
Total				3,242	1	4

The total outturn of milk during the year was 239 maunds 36 seers sold at Rs. 1,218.

In addition to this the sum of Rs. 510 was realized from the sale of cattle.

Demonstrations.

15. With the object of bringing to the notice of cultivators the benefits derived from spraying potatoes with Bordeaux mixture and also from the use of oilcake as a manure for potatoes, demonstrations were arranged on several cultivators' holdings within a ten mile radius of the Farm.

The whole of the spraying demonstrations with Bordeaux mixture were carried out by members of the Farm staff, the spraying being done under their supervision and the weights of potatoes recorded by them personally.

It was found impossible to arrange that this should be done in the case of the oil cake manuring demonstrations, so careful instructions were issued to the cultivators when the oil a cake was sent out and they were left to conduct the demonstrations and to note the results themselves.

(*a*) *Demonstrations with Bordeaux mixture.*

These were carried out on seven cultivators' holdings.

The size of the plots varied widely but averaged about $\frac{1}{80}$ acre.

On each holding two plots were laid out side by side one plot being sprayed twice with a total of 240 gallons of Bordeaux mixture per acre, while the other plot was untreated.

The results obtained on the various holdings are tabulated below :—

No.	Name of cultivator.	Place.	Yield per acre.		Excess yield on sprayed plot over unsprayed.	Value of increase at Rs. 2 per maund.	Remarks.
			Sprayed plot.	Untreated plot.			
1	2	3	4	5	6	7	8
			Mds.	Mds.	Mds.	Rs.	
1	U Mama ...	Umlyngka ...	382½	240	142½	285	It was noticed in every case that the proportion of large to small tubers was much greater in the sprayed plots than on the untreated plots.
2	U Syngap ...	Ditto ...	143	94½	48½	97	
3	U Sorendro ...	Rajbari ...	251	169	82	164	
4	U Bythah ...	Upper Shillong	306½	237	69½	139	
5	U Bowieh ...	Ditto ...	175	104	71	142	
6	U Krisbon ...	Ditto ...	244½	203½	41	82	
7	K. Porin ...	Ditto ...	115	54	61	122	

The cost of spraying, including cost of materials and labour for applications, works out at only Rs. 13 per acre, whereas the increased yields of potatoes vary from 41 maunds to 142 maunds, which at Rs. 2 per maund come to Rs. 82 and Rs. 284 per acre, respectively.

Owing largely to the success of these demonstrations, numbers of Khasia cultivators have applied to us for the use of spraying machines.

As the present prices of efficient spraying machines is a little beyond the means of the ordinary small holder, we are arranging to let machines out during the spraying season at a small fee. In course of time we hope to induce groups of small cultivators to club together and purchase machines which will be passed round among themselves.

During the present season we intend to make more demonstrations over a wider area and on larger plots.

For this purpose we shall send out two young Khasias who have been trained as apprentices on the Farm during the last two years.

(*b*) *Demonstrations with oil cake as a manure for potatoes.*

These demonstrations were carried out by the cultivators themselves.

Nine cultivators were given 10 seers of oil cake each.

They were instructed to take two plots, each $\frac{1}{80}$ acre in area.

Both plots were to receive cowdung at the rate of 300 maunds per acre and one plot 10 seers of oil-cake (20 maunds per acre) in addition to the cowdung.

Eight of the cultivators followed the instructions carefully, except that in a few cases the plots were reduced in size and the quantities of manure reduced accordingly. The other man tried the oil cake against an unknown quantity of wood ashes instead of cowdung.

Two of the demonstrations were failures, the oil cake plot giving a decrease, but in one case this was accounted for by bad germination and in the other case by disease. The other six demonstrations showed increases of from 50 to 118 maunds per acre of potatoes due to the addition of oil cake.

In the case where oil cake was added to wood ashes there was an increase of only $14\frac{1}{2}$ maunds per acre.

Receipts and expenditure.

16. The total receipts of the Farm for the twelve months amounted to Rs. 1,903, practically the whole of which was due to sale of milk (Rs. 1,218) and cattle (Rs. 510).

The total expenditure Rs. 4,644.

Management.

17. The Upper Shillong Station and the Fruit Station are managed by one Farm Superintendent assisted by an overseer and a Fieldman clerk. There are also two apprentices who are being trained to act as Demonstrators.

The Stations were frequently inspected by the Director and Assistant Director of Agriculture during the year.

A. G. BIRT,

Offg. Assistant Director of Agriculture,
Eastern Bengal and Assam.

ANNUAL REPORT ON THE TROPICAL PLANTATION AT WAHJAIN FOR THE YEAR ENDING THE 30TH JUNE 1908.

History and description.

The tropical plantation was started in January 1904. It is situated on the southern slopes of the Khasi Hills, the home of the Sylhet orange, and occupies the top and slopes of a ridge about 1,200 feet above the sea level. The site of the plantation was selected by Rai B. C. Basu Bahadur. It is close to the Cherrapunji-Theria bridle path and about seven miles below Cherrapunji.

The plantation was opened under the orders of Sir Bampfylde Fuller with the idea of experimentally introducing certain of the tropical products of Ceylon and Madras, the most important among these being cocoa, the greater and the lesser cardamom, cinnamon, nutmeg, clove, camphor, and lemon grass. Mr. Basu was deputed by Government in the autumn of 1903 to Madras and Ceylon to study the cultivation of these products and to procure seeds and plants. Various tropical fruit trees, new to the Khasi Hills, have been procured for trial and planted at Wahjain. Most of the trees planted were obtained from the Royal Botanical Garden at Peradeniya in Ceylon and from Madras. The plantation also contains a small area planted with coffee which has been in recent years introduced by private enterprise into the Khasi Hills, and a large number of the more common economic plants of the country, such as oranges, different species of citrus, betel-nut, pan and black-pepper. These are being cultivated for observation and study.

The plantation has an area of 53·54 acres. The whole area was under forest at the time of acquisition. The first operation undertaken was to mark out a number of fields and to remove the forest by felling and burning. In two fields the forest has not been wholly removed; the larger trees having been retained for shade and the ground underneath cleared of undergrowth. These two fields are intended for the rearing of such plants as cardamoms, which are unable to stand full exposure to the sun. Up to the close of the year under report, 14·50 acres had been planted. This area is divided into six fields, the lowest of which is 600 feet below the top of the ridge.

2. The surface of the land is strewn with boulders, which give it an uniniting appearance. The boulders prevent the soil which lies among them from being washed away by the heavy rain which falls on the southern slopes of these hills. The rocky nature of the ground does not permit of plough or spade cultivation.

Soil.

The rocks on the surface are mostly sandstone, but outcrops of limestone are seen at several places. The soil in the greater portion of the plantation is a loose loam, dark on the surface owing to admixture of organic matter, but of a yellowish colour underneath. The soil is mixed with gravel. In places the soil is very sandy and trees planted in it do not thrive well. Among the limestone rocks the soil is of an adhesive texture, very different in quality from the soil found on the greater portion of the plantation.

Two samples of soil from the plantation were analysed by Dr. Leather with the following results :—

—	No. 1.	No. 2.
1	2	3
Per 100 *parts of whole soil.*		
Stones	3·62	17·48
Fine earth	96·38	82·52
	100·00	100·00
Per 100 *parts of fine earth.*		
Insoluble silicates and sand ...	72·63	78·43
Ferric oxide	5·13	2·86
Alumina	10 85	11·20
Manganous oxide	0·09	0·08
Lime	1·06	0·15
Magnesia	0·58	0·41
Potash	1·74	1 97
Soda	0·10	...
Phosphoric acid	0·05	0·02
Sulphuric acid	0 06	0·01
Carbonic acid	0·07	0·05
Organic matter and combined water	7·31	4·87
	100·00	100·00

—	No. 1.	No. 2.
1	2	3
Nitrogen	0·15	0·05
Available P_2O_5	0·0015	0·0004
„ K_2O	0·009	0·008

Dr. Leather reported as follows on the two samples :—

" No. 1 contains a fair amount of organic matter and nitrogen and a large amount of potash (total), but the amounts of carbonate of lime and readily available phosphates and potash are decidedly small. No. 2 is a quite different soil. It is white and contains comparatively little iron, with a high proportion of alumina. Of the chief plant foods it contains only very little, and should respond well to any complete manure."

Sample No. 1 was taken from a spot containing limestone rock, and No. 2 from a spot a few feet away which rested on sandstone. Sample No. 2 represents the main class of soil found on the plantation.

The analyses were made in connection with Mr. Basu's contribution to the Pusa Agricultural Journal of January 1906 on the cultivation of oranges in the Khasi Hills.

Climate.

3. Wahjain lies a short distance below the plateau of Cherrapunji, which holds the world's record for rainfall, and which it resembles in respect of the heavy precipitation that occurs during the spring and summer months. During the spring and early summer (March to May), the weather is characterised by high winds and frequent thunderstorms, with heavy bursts of rain, which bring on a quick growth of vegetation. The monsoon follows with rainfall not much less than that of Cherrapunji itself, and is succeeded about the middle or end of October by calm and almost rainless weather, which continues through the winter till about the middle of March.

There is far too much rain during eight months of the year and practically none for a continuous period of four months. Here in the climate of Wahjain differs from that of Ceylon and other tropical countries where such long periods of drought are unknown. The absence of rain has been found

particularly trying to such essentially tropical plants as the nutmeg and clove. It is also very possible that the winter temperatures of Wahjain are too low to suit such plants. The lowest recorded temperature in the shade was 43°F. in February 1905 and the highest 90°F. in May 1908.

Character of the season.

4. The rainfall on the plantation from July 1907 to June 1908 was as follows :—

Month.	Rainfall.	No. of rainy days.
1	2	3
	Inches	
1907, July	106·10	31
„ August	48·08	28
„ September	52·95	24
„ October	nil	0
„ November	nil	0
„ December	0·30	1
1908, January	1·21	3
„ February	0·26	1
„ March	3·01	3
„ April	17·70	17
„ May	31·17	18
„ June	37·03	22
Total for the year ...	297·81	148

Rainfall has been recorded at Wahjain since September 1904. The normal rainfall of the place cannot be stated until the record has extended over a longer period. This season the long drought from October to March was very trying to most of the plants.

Work done during the year.

5. On account of the extremely rocky character of the ground the method of cultivation is very simple and consists only of loosening the soil around the plants and keeping down jungle growth.

During previous years liquid manure prepared from cowdung and water was applied weekly to the more important plants, but for the year under report liquid manuring was discontinued and instead, mustard oil cake was applied

in September 1907 at the rate of from 1 to 4 chittaks to each plant, the quantity varying according to the size and age of the plant.

Since then the following scheme of manuring has been drawn up by Mr. Basu :—

	Per tree.	Per acre.
1. *For Coffee*—		
Fish manure ...	1 seer	10 maunds.
Potassium Sulphate	2 chittaks	1¼ „
2. *For Pineapples*—		
Oil cake ...		5 maunds.
Potassium Sulphate		1½ „
Mineral superphosphate		2 „

3. *For Cocoa, nutmeg, Sondoricum, Soursop, Rambutan, Namnam, Breadfruit, Japanese Orange, Mangosteen and Clove*—

Fish manure ...	8 parts	from ¼ seer to 1 seer per tree according to size.
Potassium Sulphate	1 part	

4. *For Poona Plantain*—

Fish manure ...	2 seers	per clump.
Potassium Sulphate	½ seer	

5. *For greater and lesser Cardamom*—

Cowdung	about 20 seers	per clump.
Fish manure	½ to 1 seer	
Potassium Sulphate	1 to 2 chittaks	

The above manures to be applied in two or three doses from March to June.

During the year under report fish manure could not be obtained, so the same amount of oil cake was substituted. The manures were applied in two doses, one in May and the other in June.

About 50 coffee plants have been left unmanured as controls.

In January the soil at the base of the cocoa plants was "mulched" with the refuse from the distillation of lemon grass oil. In future this will be done at the commencement of the cold weather. It is hoped in this way to conserve the soil moisture which rapidly dries up in the cold weather on this rocky land.

The only new plants introduced during the year were cashewnuts from Midnapore in Bengal, Bangalore papaya, China pineapple from the Reporter on Economic Products, Calcutta, Khasia cinnamon and Khasia greater cardamom from Shillong.

Three cuttings of lemon grass and distillations of lemon grass oil were made during the year, the first commencing on July 6th, 1907, and finishing on August 17th, the second from 2nd November to 14th December and the third from the 20th April 1908 to 25th May.

Unfortunately it is impossible to give the weights of grass used at each distillation and the quantities of oil obtained as some of the records were destroyed by fire in March 1908. In the statement given below the results of the first two distillations are given together, while for the third distillation we are able to give the results of the three varieties of grass separately.

—	Amount of grass.	Amount of oil obtained, fluid ozs.	Cost of cutting grass.	Cost of fuel.	Cost of labour for distillation.	Cost of flour for making paste.	Total cost.	Amount of oil obtained per maund of grass, fluid ozs.
	Mds.		Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
1st and 2nd distillations.	188½	609	11 4 0	15 0 0	60 8 0	5 8 0	93 4 0	5·50
3rd distillation — Tyrna grass.	63½	273	4 1 4	2 8 0	17 1 4	2 0 0	25 10 8	4·28
Moriani grass.	23½	112	2 0 0	1 4 0	6 2 8	0 12 0	10 2 8	4·76
Lemon grass from Ceylon.	9½	43	Nil *	0 10 0	3 0 8	0 4 0	3 14 8	4·47
Total	295½	1,127	20 5 4	19 6 0	86 12 8	6 8 0	133 0 0	...

* No cost of cutting grass is given, as this was done by the same men who distilled the oil.

In the first and second distillations the amount of oil obtained per maund of grass is low compared with the amount obtained in the third distillation. This was partly due to inexperience on the part of the distillers who, by the time the third distillation was made, had gained more experience and were better able to prevent wastage.

The total amount of oil produced during the year was 1,127 fluid ounces, and the total cost of manufacture, including the cutting of grass, was Rs. 133. If the value of an ounce be annas 4 then the total value will be Rs. 281-12.

The cost of cultivation has not been considered, but this in the case of an ordinary hill cultivator would be reduced to a minimum. After the grass is planted practically the only thing to be done is to keep down the jungle. The cost of manufacture as given above also far exceeds the amount which would be incurred by him, as most of the work is done by himself and family. The above figures, however indicate that a very handsome profit can be made out of the manufacture of lemon grass oil in the Khasi Hills.

We have disposed of 526 ounces of oil at annas 4 per ounce to a soap manufacturer, but we have decided not to sell any more until we have received the valuation of some samples which have been sent to London through the Director General of Commercial Intelligence.

Plants under trial.

6. The annexed list shows the various species of plants under trial, the sources from which they were obtained, their age and the progress which each species has made. In the case of the plants which have begun to yield the results obtained have been noted in the remarks column.

The most important plants, namely, those for the sake of which the Tropical Plantation was created, are cocoa, coffee, lesser cardamom, cinnamon, nutmeg, clove, citronella and camphor. There is no citronella at Wahjain, none of the plants from Ceylon having reached the plantation alive, lemon grass is being cultivated in its place. Cocoa, camphor, cinnamon, lemon grass and coffee are doing well.

Camphor.

7. The camphor trees are making good growth, but, are not yet large enough to admit of pruning. It is proposed to try the method of distilling camphor from twigs on the system which has been experimentally introduced in Ceylon.

Coffee.

8. The coffee trees are now about 5 feet high and were topped and pruned in January. It is proposed to keep them down to about this height by nipping off the leading shoot.

Cinnamon.

9. The cinnamon trees are very healthy and have a good growth of wood.

10. *Cardamom.*—The greater and lesser cardamom plants are not doing well. They are attacked by a root fungus disease which has killed all but one clump of the greater cardamom in one field, and out of a total of 169 clumps which were on the plantation in July 1903, only 11 clumps now remain.

Cardamom.

About 100 new clumps which were found growing wild near Shillong were planted in June 1908, and so far these have not been attacked by the disease.

11. The total area under lemon grass is now 351 acres. As shewn in the annexed list, this was obtained from four different places, *viz.*,Ceylon, Tyrna (Khasi Hills), Moriani (Assam), and Cochin (Madras). Only the grass from Cochin has flowered and it has been identified by Captain Gage, Superintendent, Royal Botanic Gardens, Sibpur, as *Andropogon nardus, L.*

Lemon grass.

The clumps of lemon grass were originally planted in rows 3 feet apart, with an interval of 3 feet between the clumps in the row, but during the year under report on about half the area, additional rows were planted, so that now there is an interval of only 1½ feet between the rows.

12. *Nutmeg.*—Is growing very slowly; the climate seems to be too dry for it in the cold weather. The cloves have all died out. The climate of this place is evidently unsuitable.

Nutmeg.

13. Of the plants subsequently introduced into the scheme of the plantation, pineapples, Natal oranges, sopota, litchi and mango trees are doing well.

14. *Plant diseases.*—The only serious disease noticed in the plantation is that which attacks the roots of the greater and lesser cardamom. Specimens of the diseased roots were sent to Dr. Butler, Imperial Mycologist. He reports as follows:—"The disease appears to be due to a parasite similar to that which causes wilt disease of cotton, pidgeon pea, etc, in many parts of India. This is a soil fungus which infects the roots from the soil and spreads from plant to plant through the latter. The only treatment is to pull up and destroy diseased plants in order to protect healthy ones from infection."

Fungus disease of cardamoms

Acting on Dr. Butler's advice all diseased plants were uprooted and burnt. Lime was mixed with the soil in the holes from which the diseased plants had been removed.

This was done in April, but since then several more plants have been attacked. These have also been removed and burnt and lime has been applied in the holes. It is hoped that by persevering in this drastic treatment we may eventually stamp out the disease.

Orange blight.

15. The orange blight which is so prevalent in the Khasi Hills and which is being investigated by Dr. Butler has not yet appeared on the plantation.

In last year's report it is mentioned by Mr. B. C. Basu in connection with this disease that arrangements were being made to make experiments in gardens with a view to check the ravages of the blight:—

(*a*) By trying to obtain a hardier species of citrus which will withstand the disease, and on which orange may be grafted.

(*b*) By cutting off the connection between healthy and unhealthy trees by deep trenches.

(*c*) By liming the soil at the base of the trees.

For the purpose of experiment "*a*" a small disease orange garden was lent to us by a Khasia cultivator. All the diseased trees were cut down, leaving their roots in the ground.

Eleven different species of citrus trees, in all 86 plants, were planted close to the diseased roots in July 1907. On the 30th June 1908, 69 trees were found to be alive. All these trees are thriving and there is no sign of disease as yet. Seventeen trees had died during the year. The roots of all these were examined (by the eye, not microscopically) for disease, but no sign of it could be found. The death of the trees was probably due to careless planting followed by heavy rain. The living trees will be carefully watched for any signs of disease.

In experiment "*b*" an area of about 2,000 square feet of ground, carrying apparently healthy orange trees, has been lent by a cultivator at Mowkdup, about 2 miles from Wahjain. This piece of land is part of an orange grove, where trees here and there are affected by the disease. The plot is bounded on one side by a stream.

In June 1908 a trench 3 feet deep (where possible) and 2½ feet wide was cut round the three sides of the plot which are bounded by orange trees with the object of ascertaining whether this will have any effect in checking the disease from spreading to the healthy trees within the plot.

For experiment "*c*" twenty-four badly diseased orange trees have been selected in a garden at Umlong. The surface soil within a radius of 3 feet from the stems and to the depth of 6 inches was removed from around 12 of these trees. The soil from around each tree was mixed with 10 seers of slaked lime and then replaced. The other twelve trees were left untreated. This was done at the end of June 1908, so it is too early to draw any conclusions.

Receipts and expenditure.

16. The expenditure on the plantation during the year amounted to Rs. 972-12-8.

Inspection.

17. The plantation was inspected by the Director of Agriculture once during the year and twice by the Assistant Director.

List of plants at the Tropical Plantation, July 1908.

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
1	Cocoa (the *Theobroma cacao*).				
	"Amelando" ...	Grown from Ceylon seed.	August 1904.	2	Out of 20 trees planted in the rains of 1904, only 11 now remain. The tallest of these is about 5 feet high. The cocoa trees are growing too slowly to promise success.
	Ditto ...	Ditto ...	Rains 1905	2	
	"Caracas" ...	Ditto ...	August 1904	2	
	Ditto ...	Ditto ...	Rains 1905	1	
	"Forastro" ...	Ditto ...	August 1904	4	
	"Candelmar" ...	Ditto ...	Rains 1904	15	The tallest of these is about 6 feet high.
			Total ...	26	

List of Plants at the Tropical Plantation, July 1908—contd.

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
2	Lesser Cardamom (*Elettaria Cardamomum*).				
	"Palni" ...	Palni Hills ...	June 1904	4	The plants do not look promising as last year. Many clumps were attacked and killed by a fungus disease. Some of them are now following.
	Ditto ...	Grown from seed, procured from the Palni Hills in Madras.	April 1905	13	
	Ditto ...	Ditto ...	June 1906	18	
3	"Mysore" ...	Plants obtained from Ceylon.	Ditto ...	8	
			Total ...	38	Clumps.
	Greater Cardamom (*Amomum Subulatum*).	Plants obtained from the Lloyd Botanical Garden, Darjeeling.	June 1904	2	Many clumps were attacked and killed since two years ago by a fungus disease.
	Ditto ...	Ditto ...	June 1906	9	Plants obtained by breaking up old clumps of June 1904, in field "C" where they were not growing well owing to sandy soil and want of shade. These plants were also attacked and killed by the same disease.
	Ditto ...	Plants obtained from Shillong.	June 1908	100	
			Total ...	111	Clumps.
5	Nutmeg (*Myristica fragrans*).	From Ceylon seed	April 1905	24	Only 24 have survived out of 80 seedlings planted in 1905. The plants are still very small though apparently healthy. The best of them are 15 to 24 inches high. The plants are growing so slowly that I do not expect they will succeed.
6	Cinnamon (*Cinnamomum Zeylanicum*).	Ditto ...	Ditto ...	22	The 22 clumps contain 68 plants. They have made good growth. Plants are stooling now. Tallest feet 9 inches high. Promising.
7	Khasi (*Cinnamon*).	Locally procured...	September 1907.	9	

List of Plants at the Tropical Plantation, July 1908—contd.

rial No. of spcel.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
	2	3	4	5	6
8	Camphor (*Cinnamomum Camphorum*).	Plants from Ceylon	July 1904	9	Growing beautifully. The plants are bushy and displaying an exuberant growth.
9	Coffee (*Coffea Arabica*).	Locally procured ..	May 1904	26	Growing very well. Most of the trees are now in bearing and a fair yield of berries is expected.
	Dito	Ditto ...	April 1905	333	Growing well. Most of the trees of 1905 and 1906 are now in bearing.
	Ditto ...	Ditto ...	June 1906	493	
	Ditto	Ditto ...	June 1907	100	
	Ditto ...	Ditto ...	June 1908	164	
			Total .	1,125	
10	Orange (*Citrus Aurantium*).				
	"Victoria Mammoth" or "Natal."	Natal ...	April and June 1904	9	Growing remarkably well. Three trees flowered last spring and only one is bearing 12 fruits now.
	"Jamaica" ...	From Jamaica seed	June 1907	13	Growing well. The trees were infested with a scale insect and treated with resin soda wash.
	"Malta" ...	Lahore ...	April 1908	4	Growing well and two of them are bearing some fruits.
	"Japanese Orange"	Japan ...	June 1907	1	
	"Khasia" ...	Local ...	June 1904	50	Growing very well. Some of them flowered last spring and only one is bearing a single fruit.
	Ditto ...	Ditto ...	June 1906	630	Growing well.
			Total ...	707	

List of Plants at the Tropical Plantation, July 1908—contd.

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
11	Citrus of different species—				
	"Malta Citron"	Cutting from a tree in the abandoned Government citrus plantation at Theriaghat.	Summer 1905.	4	Growing well.
	"Soh-mad" (*citron*).	Ditto ...	Ditto	24	Making fair growth.
	"Soh-myndong"	Ditto ...	Ditto	22	
	"Soh-kwit" ...	Ditto ...	Ditto	24	
	"Soh-myngor" ... (*pummelo*).	Ditto ...	Ditto	17	
	"Soh-niamriang"	Ditto ...	Ditto	17	
	"Soh-pai" ...	Ditto ...	Ditto	33	
	"Soh-khyllah" ...	Ditto ...	Ditto	11	
	"Soh-thang" ...	Ditto ...	Ditto	13	
	"Soh-siing" ...	Ditto ...	Ditto	21	
	C. decumana ...	Japan ...	June 1907	2	Do not make any growth. The trees were infested with scale insects and were treated with resin soda wash.
	C. Medica Chirocarpa.	Ditto ...	Ditto	1	
	C. Nobilis satsuma	Ditto ...	Ditto	2	
	C. Nobilis Kinakuni.	Ditto ...	Ditto	2	
	C. Nobilis Umshim	Ditto ...	Ditto	1	
	C. Kinkan (round fruit).	Ditto ...	Ditto	1	
			Total ...	185	
12	Litchi (grafted) (*Nephelium Litchi*)—	Calcutta ...	June 1904	2	Growing very well. One tree has borne a dozen fruits.
13	Mango (grafted) (*Mangifera Indica*).				
	"Pakli" ...	Ditto ...	Ditto ...	2	All growing well.
	"Langra" ...	Ditto ...	Ditto ...	3	
	"Bombay" ...	Ditto ...	Ditto ...	2	
	Total ...	.....	.....	6	

List of Plants at the Tropical Plantation, July 1908—contd.

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
14	Sapota (*Achras sapota*).	Calcutta ..	June 1904	2	Growing very well. Both flowered again this year, but set no fruit.
15	Papaya (*Carica papaya*)—				
	" Bangalore " ...	From garden seed	June 1908	14	Seed obtained from Bangalore.
16	Pine-apple (*Ananas sativas*), " Ceylon. "	Dibrugarh Jail and suckers from original plants.	Rains 1904 and 1905.	430	All growing well. The plants of 1904 have been bearing since 1907. This pineapple is of larger size than the country fruits; the eyes are shallow, flesh white, very succulent and of nice flavour, though slightly more sour than the indigenous kinds. The leaves differ from those of country variety in having smo th edges. The variety is expected to be popular.
	Ditto	Ditto	July 1907	267	
	"Calcutta"	From Reporter on Ecomomic Products to the Government of India, Calcutta.	September	2	
	" China "	.....	October	10	
	" Kew " ...	Ceylon ...	July 1904 July 1906 July 1907 February	10 5 4 2	Growing well. The older plants are now in bearing. The quality of the fruit remains to be seen.
			Total ...	730	
17	Plantain (*Musa sapientum*)—				
	Strawberry-flavoured " Bombay. "	Empress Botanical Gardens, Poona.	May 19	11	Growing slowly. The soil is too poor for planting unless it is planted directly after burning the forest. We had three bunches of fruit this year and one is bearing now. *N.B.*—Besides these, the plantation contains a large number of Khasi and Assam Valley plantain of several varieties, grown chiefly for the sake of shade. The clumps have become old and are dwindling.

List of Plants at the Tropical Plantation, July 1908—contd.

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
18	Breadfruit (*Artocarpus incisa*).	Ceylon ...	July 1904	2	Growing slowly. The plants suffered from the frosts of 1905, otherwise they would have grown to a greater height. At present they are about 2' 6" high and look healthy. They were covered with thatch in the dry season as protection against sun.
19	Mangosteen (*Garcinia Mangostana*).	Ditto ...	April 1907	7	The plants exhibit very little growth and are most unpromising. Two of the plants were attacked by blight and treated with Bordeaux mixture.
20	Nam-nam (*Cynometra cauliflora*).	Ditto ...	July 1904	2	These plants were received from Peradeniya for trial. It is not known what the fruits would be like, except in case of Cochin Goraka, which is wild in the Assam forests and known as tejor tenga in Assam Valley and dia-phal in Sylhet. Ketambella and Saudoricum are growing well. Nam-nam and Cochin Garaka show very poor growth.
21	Saudoricum (*Sandoricum sp*).	Ditto ...	Ditto ...	1	
22	Ketambella (*Aberia gardneri*).	Ditto ...	Ditto ...	2	
23	Cochin-Goraka (*Garcinia Xanthochymus*).	Ditto ...	Ditto ...	2	
24	Rambutan (*Nephelium lappaceum*).	Plants from Ceylon	July 1904	2	The plants are growing slowly. The tallest is 8' high.
	Ditto ...	Raised from Ceylon seed.	April 1905	7	
			Total ...	9	
25	Soursop (*Anona muricata*).	Plants from Ceylon	July 1904	8	Growing fairly well. Tallest plant is 4' 9" high.
		Raised from Ceylon seed.	April 1905	16	
			Total ...	24	
26	Betel-nut (*Areca Catechu*).	Local ...	1905 ...	206	This number has survived out of some five hundred planted in 1905 along the boundaries of fields A, B, C, and E. They are growing very slowly.
27	Betel-leaf (*Pan, Piper betel*).	Ditto ...	August 1904	3	These have survived out of 30 plants planted in 1904 and 100 in 1905. Growing well. Being grown for observation and study.
			June 1905	20	
			Total ...	23	

List of Plants at the Tropical Plantation, July 1908—concld.

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
28	Cashew nuts ...	Raised from seed...	June 1903	230	These have survived out of 30 plants planted in 1904 and 100 in 1905. Growing well. Being grown for observation and study.
29	Black pepper (*Piper nigrum*).	Local ...	August 1904	5	
			June 1905	28	
			Total ...	33	
30	Lemon grass (*Cymbopogon citratus*).	From three distinct sources, viz.:—	See column 3.	Area. Sq. ft.	
		(1) Ceylon under name of lemon grass in April 1905.	.....	15,671	
		Ditto ...	1907 ...	7,939	
		Ditto ...	1908 ...	4,428	
		(2) Tyrna in August 1904; name not known.	.....	83,972	
		(3) Moriani, Assam Valley, in December 1901; name not known.	.....	31,823	
		Ditto ...	.....	485	
	Lemon grass (*C. flexuosus*).	Cochin under name of lemon grass in June 1906-1907.	.....	6,073	
		Ditto ...	1908 ...	2,000	
			Total ...	153,505 or 3·51 acres.	
	Rusa grass (*C. Martini*).	From seed obtained from Central India (through Reporter on Economic Products).	June 1905	Clumps. 20	This plant yields the *rusa, or palmarosa oil of commerce. The plants* look unhealthy and are not likely to succeed.
	Total clumps of grass fit for distillation.	.....	.....	5,607	
			Grand total	5,627	Clumps.

ANNUAL REPORT OF THE AGRICULTURAL STATIONS

IN

EASTERN BENGAL AND ASSAM

FOR THE

Year ending the 30th June 1909.

SHILLONG:
PRINTED AT THE EASTERN BENGAL AND ASSAM SECRETARIAT PRINTING OFFICE.

1910.

Price 1 Shilling] [Price 12 Annas.

Agents for the Sale of Books published by the Eastern Bengal and Assam Government.

Agents in India.

(1) Messrs. Thacker, Spink & Co., Calcutta.
(2) Messrs. W. Newman & Co., Calcutta.
(3) Messrs. S. K. Lahiri & Co., Calcutta.
(4) Messrs. A. M. and J. Ferguson, Ceylon.
(5) Messrs. R. Cambray & Co., 6 and 8/2, Hastings Street, Calcutta.
(6) Messrs. Thompson & Co., Madras.

Agents in England.

(1) Mr. E. Arnold, 41 and 43, Maddox Street, Bond Street, W., London.
(2) Messrs. Constable & Co., 16, James Street, Hay Market, W., London.
(3) Messrs. Kegan Paul, Trench, Trübner & Co., 43, Gerrard Street, Soho, W., London.
(4) Mr. B. Quaritch, 15, Piccadilly, W., London.
(5) Messrs. P. S. King & Son, 9, Bridge Street, Westminster, S.W., London.
(6) Mr. B. H. Blackwell, 50 and 51, Broad Street, Oxford.
(7) Messrs. Deighton Bell & Co. Cambridge.
(8) Messrs. Henry S. King & Co., 65, Cornhill, E.C., London.
(9) Messrs. Grindlay & Co., 54, Parliament Street, S.W., London.
(10) Mr. T. Fisher Unwin, 1, Adelphi Terrace, London, W.C.

Agents on the Continent of Europe.

(1) MM. Friedländer & Sohn, 11, Carlstrasse, Berlin.
(2) M. Otto Harrassowitz, Leipzig.
(3) M. Karl Hiersemann, Leipzig.
(4) M. Ernest Leroux, 28, Rue Bonaparte, Paris.
(5) Martinus Nijhoff, The Hague.
(6) Mr. Rudolf Haupt, Halle-a.-S., Germany.

SHILLONG:
PRINTED BY H. KING OFFG. PRINTING SUPERINTENDENT E. B. & ASSAM.

CONTENTS.

ANNUAL REPORT OF THE DACCA AGRICULTURAL STATION.	Pages.	Paras.
Map of Dacca Central Farm.		
Introduction	1	1
Lands	1-2	2
Work done during the year	2	3
Clearing and levelling	2-3	4
Road-making	3	5
Buildings	3-4	6
Reclamation of tanks	4	7
Experimental cultivation	5-9	8
High land experiment	5-6	*ib.*
Winter rice experiments—		
(*a*) Manurial experiments	6-8	*ib.*
(*b*) Variety experiment	8	*ib*
Other experiments—		
Ground-nuts	8-9	*ib.*
Potatoes	9	*ib.*
Oats, peas and *khesari*	*ib.*	*ib.*
Non-experimental cultivation ...	9-10	9
Establishment	10-11	10
Cattle	11	11
Implements	11-12	12
Receipts and expenditure	12-13	13
Appendix	13-13	

ANNUAL REPORT OF THE BURIRHAT AGRICULTURAL STATION.		
Map of Burirhat Farm.		
Introductory	17	1
Distribution of land	*ib.*	2
Soil	*ib.*	3
Buildings	*ib.*	4
Weather	18	5
Work done during the year	18-19	6
Tobacco	20-25	7
Oats	25	8
Mustard	*ib.*	9
Potatoes	*ib.*	10
Supply of seed	26	11
Receipts and expenditure	*ib.*	12
Establishment	*ib.*	13
Inspection	*ib.*	14
Appendix I	26-27	
„ II	27	

ANNUAL REPORT OF THE RAJSHAHI AGRICULTURAL STATION.

	Pages.	Paras.
Map of Rajshahi Farm.		
Introduction	29	1
Soil	*ib.*	2
Distribution of land and plots ...	*ib.*	3
Buildings	29-30	4
Rainfall	30-31	5
Programme of experiments	31	6
Sugarcane—		
Variety experiment	31-35	7
Manuring experiment	35-38	8
Jute experiment	38-40	9
Wheat experiment	40-41	10
Potatoes	41-42	11
Ma'ancha	42	12
Ground-nuts	*ib.*	13
Non-experimental crops	42-43	14
Distribution of seeds	44	15
Receipts and expenditure	*ib.*	16
Inspection	*ib.*	17
Appendix	44-46	

ANNUAL REPORT OF THE JORHAT AGRICULTURAL STATION.

	Pages.	Paras.
Plan of Jorhat Farm.		
Introduction	47	1
Soil	*ib.*	2
Preparation of the land for experiments ...	47-48	3
Buildings	48	4
Rainfall, etc.	48-49	5
Experiments	49	6
Ratoon sugarcane	49-52	7
Plant cane...	52-53	8
Barbadoes cane	53-55	9
Field observations	55-57	10
Sugarcane—General remarks ...	57	11
Manuring experiment with winter paddy	57-58	12
Ground-nuts	58	13
Other crops	58-59	14
Fruit trees	59-60	15
Receipts and expenditure	60	16
Establishment	*ib.*	17
Inspection	*ib.*	18
Appendix	60-61	

ANNUAL REPORT OF THE SHILLONG FRUIT EXPERIMENT STATION.

	Pages.	Paras.
Introductory	63	1
History and description	63-65	2
Number of fruit trees at the close of the year	65-66	3
Weather	66	4
Progress of fruit trees	66-67	5
Treatment of fruit trees	67	6
Diseases	67-68	7
Strawberries	68	8
Other crops	68-70	9-11
Sericulture	70-76	12
Distribution of plants and seeds ...	77	13
Receipts and expenditure	78	14
Statement I	79-105	
„ II	106	

ANNUAL REPORT OF THE UPPER SHILLONG AGRICULTURAL STATION.

Introductory	107	1
History and description	107-108	2
Weather	108	3
Work done during the year	*ib.*	4
Potato experiment	109	5
Variety tests	109-111	6
Manurial and spraying trials... ...	111-114	7
Whole *versus* cut sets	114-115	8
Methods of planting	115	9
Sprouted *versus* non-sprouted sets ...	116	10
Oats	*ib.*	11
Clovers and grasses	*ib.*	12
Named U Proot and U Langtylli ...	*ib.*	*ib.*
Maize breeding	117	13
Fodder crop for silage and hay ...	*ib.*	14
Cattle breeding	118-119	15
Sheep breeding	119	16
Receipts and expenditure	*ib.*	17
Demonstration	119-120	18

ANNUAL REPORT OF THE WAHJAIN AGRICULTURAL STATION.

History and description	121	1
Soil	122-123	2
Climate	123-124	3
Character of the season	124	4
Work done during the year	124-126	5
Plants under trial	126	6
Camphor	*ib.*	7
Coffee	126-127	8

	Pages.	Paras.
Cinnamon	127	9
Lemon-grass	*ib.*	10
Nutmeg	*ib.*	11-12
Fungus disease of cardamoms ...	127-128	13
Orange blight	128	14
Receipts and expenditure	*ib.*	15
Inspection	*ib.*	16
Appendices	129-139	

MAP
OF
DACCA CENTRAL FARM

SCALE 1000 = 1"

Annual Report of the Dacca Agricultural Station for the year ending the 30th June 1909.

Introduction.

THE Farm is situated about five miles north of Dacca town, and has a total area of 353·7 acres. The land was acquired in 1906. At the time of acquisition, the greater portion was covered with jungle and coarse grass.

The farm will be the main experiment station of the Province, and will also be the headquarters of the superior staff of the Department. The laboratory and officers' bungalows are under construction near the main entrance.

Lands.

2. There are three distinct types of land on the Farm :—

3 *bighas* = 1 acre (approximate).

(1) High land (about 860 *bighas*).
(2) Open lowland (about 46 *bighas*).
(3) Ravine land, or *holas* (about 164 *bighas*).

The high land forms the greater portion of the Farm. It is composed of a stiff red clay soil, the chief characteristic of which is the rapidity with which it loses its moisture and becomes hard and dry. It appears to be extremely deficient in organic matter. Before we acquired this land most of it was under jungle. Dotted here and there were the houses of a few cultivators, who grazed their cattle in the jungle and took crops of winter paddy from the surrounding *holas*. A few patches of *aus* paddy and *til* were also grown on the high land by the cultivators, but their chief means of livelihood was the cultivation of winter paddy in the *holas*.

The open low land usually becomes flooded some time during the rains, and in a normal season jute can be grown, followed by winter paddy. This land is from 2 to 3 feet below the general level of the high land. The soil is on the whole in better condition than that of the high land, as it receives some of the washings from the high land.

The ravine lands, or *holas*, wind in and out amongst the high land, cutting it up into irregular-shaped blocks. Never more than about 150 feet wide, they vary in depth from 2 or 3 feet up to 8 or 10 feet. This land has been cropped by the raiyats with winter paddy for generations, practically without manure, the fertility being sustained by

washings from the high land and by the growth of leguminous weeds, which are brought up by the early rains in the spring.

The farm on the whole may be said to be representative of a large jungle tract cut up by ravines and extending northward from Dacca town. In this jungle are scattered villages, the occupants of which regularly cultivate winter paddy on the low land and *holas*. The high land is uncultivated, except small patches here and there, where the villagers grow good crops of *aus* paddy and *til* in the rains. As soon as the rains come to an end, the land sets like a brick, so the local raiyats for the most part let *rabi* cultivation severely alone. A little *mung* or *matikalai* is cultivated in patches, but most of the high land is bare during the cold weather.

The plan of the Farm, inserted in this report, will give some idea as to the distribution of the land. Most of the high land is very uneven in character, so it has been laid out in large blocks, which will be cropped uniformly as far as possible until we are able to select plots of approximately equal fertility for experiment.

Work done during the year.

3. Except experiments with winter rice in the *holas* and an experiment on the improvement of the high land, the work of the year was mainly preparatory. It will be described in detail under the following heads:—

(*a*) Clearing and levelling.
(*b*) Road-making.
(*c*) Building.
(*d*) Reclamation of tanks.
(*e*) Experimental cultivation.
(*f*) Non-experimental cultivation.

Clearing and levelling.

4. Up to the close of the preceding year, 180 *bighas* of high land had been cleared, levelled, and plotted out, and about 270 *bighas* had been cleared of jungle, but not levelled or plotted out.

During the year under report the whole of the land which had been cleared but not levelled in the preceding year was levelled, and, in addition, about 40 *bighas* of jungle land was cleared. The mango groves were also cleared of jungle and the land ploughed. The brick-field (a piece of

land which had been spoilt for cultivation) was cleared and levelled and laid out in sites for the laboratory assistants' quarters.

At present the farm is divided approximately as follows :—

	Bighas.
Ravines	164
Open lowland	46
High land cleared and levelled	440
High land cleared but not levelled	43
Mango groves	70
Reserved for paddock	15
Land carrying thatching grass and scrub jungle and pasture not yet broken up	80
Sites for buildings, roads, etc.	156
Tanks	5
Waste	15
Total	1,070

Road-making.

5. The brick-field was connected with the main road by a road about 300 yards long carried over the intervening *hola* by a bund in which was constructed a masonry culvert.

The Public Works Department have in hand the metalling of the main road, which is about a mile long, running from the main entrance of the farm to the farm buildings. They expect to complete this work before the end of the rains.

Buildings.

6. All the buildings under construction departmentally at the close of the preceding year have been completed, and a block of four quarters for apprentices was built at a cost of about Rs. 500. At the close of the year under report the following buildings were well advanced in construction, and will be ready for occupation by the end of the rains :—

Seed Depôt Superintendent's quarters (costing Rs. 2,200).

Three blocks of double quarters for laboratory assistants and clerks at a cost of about Rs. 1,500 for each block.

These quarters are of a type usually designed for clerks, and it is not intended that they should be the permanent quarters of the laboratory assistants; but owing to shortage in funds and the necessity for providing accommodation for the assistants by the time the laboratory is ready, we were unable to carry out our original plans for the assistants' quarters. When we are able to build permanent quarters for the assistants the buildings now under construction will be used for clerks and [illegible]men.

In addition to the abovementioned buildings, under construction, the farm is equipped as follows:—

Farm buildings, comprising cattle sheds, godowns, office, workshop, and quarters for chaukidar and two cattle men. These were erected by the Public Works Department at a cost of Rs. 28,750. The cattle-shed is badly planned, and a great deal of space is wasted at present. During the current year we propose to so alter half of the cattle-shed that it will take a double row of cattle instead of a single row as at present; the other half will be converted into a godown for the seed depôt. We also propose to enlarge the workshops by taking down a partition and to entirely rearrange the godowns. The floors of two of the smaller godowns will be taken up and relaid over cinders, as at present the damp penetrates the floors. The total cost of these improvements is not expected to exceed Rs. 2,500.

Agricultural Supervisor's house (costing Rs. 2,500).

Supernumerary Farm Superintendent's house (costing about Rs. 2,000).

Three quarters for overseers (costing about Rs. 650).

One block of four apprentices' quarters, cost about Rs. 500.

During the year under report four culverts of *pucca* masonry, connecting *holas*, were constructed on the Farm at an average cost of about Rs. 450 each.

During the current year we propose to build another block of apprentices' quarters and also quarters for the Seed Depot Clerk.

Reclamation of tanks.

7. There are four tanks on the Farm, *viz.*, Santi, Hazi, Mirpur, and Shoti. The Santi tank had become silted up, and, being near the farm buildings and the farm staff quarters, it was resolved to completely renovate it. The work of excavation was commenced in the spring of 1908, but only a small amount of work had been done when the early rains rendered further progress impossible. The work was taken up again in January 1909, and proceeded till the end of the year under report, when the excavation was complete, and dressing the banks only remained to be done. The total cost of renovating this tank is estimated at about Rs. 3,700.

A smaller tank, named the Mirpur tank, was reclaimed at a cost of about Rs. 700.

Work was commenced on the Hazi tank, but was stopped owing to lack of funds. It is proposed to reclaim this tank and also the Shoti tank when funds are available.

8. This was necessarily limited as the Farm was new, and we knew very little about the evenness or otherwise of the land; but as the ravine land had been under cultivation practically without manure for a very long time, we were able to commence experiments with winter paddy on selected portions of land. In addition to the winter paddy experiments, the only other experiment of much importance was one designed to contrast the effect of different treatment in the improvement of the high land.

Experimental cultivation.

The experiments are explained in detail below:—

High land experiment.—This experiment on the improvement of the typical high land red soil of the Farm is intended to be permanent. As before stated, this red soil is deficient in organic matter and loses its moisture very rapidly. To ascertain the best means of bringing this land into a state of fertility, four plots—A, B, C, & D—in Shoti field W., each four *bighas* in area, were laid down in the spring of 1908. The treatment of each plot is described briefly below:—

Plot.	1908.		1909.	
	Kharif.	*Rabi.*	*Kharif.*	*Rabi.*
1	2	3	4	5
A	*Aus* rice (no manure).	Mustard (no manure).	Jute (light dressing cowdung.)	*Til* (no manure).
B	*Jowar* (no manure), ploughed in for green manure.	*Sann* (no manure), ploughed in for green manure.	*Dhaincha* (no manure), ploughed in for green manure.	Oats (no manure.)
C	Sown with *Boga Medaloa* in spring of 1908 with the object of letting this crop stand on the ground for two years. It was to be pruned at the end of the first year, and the prunings ploughed in.			
D	Duplicate of plot A.			

Boga Medaloa is a leguminous plant used by some Assam tea-planters for planting between the rows of *tea*. The plants are regularly pruned, and the prunings are hoed into the ground for green manure. Through a misunderstanding, the crop was sown broadcast instead of in rows on the Dacca Farm; it made tremendous growth during the first year, attaining a height of nearly 12 feet, with thick woody stems. Under the circumstances, it is impossible either to plough in the whole crop or to prune it and plough in the prunings. We shall probably have to cut the whole crop, cut off the young shoots and plough them in, and cart away the woody stems for firewood. We do not intend to try this crop again.

The land for this experiment was selected as being fairly uniform as far as could be judged at the time, but before the first crops had been on the land very long it became apparent that the land was anything but uniform. I therefore do not propose to give any figures for the crops harvested up to date. The following brief notes on the first two seasons' crops might be interesting as indicating the kind of land with which we are dealing.

Plots A and D.—Aus rice grew well, and yielded a good crop. Mustard sown, as the *rabi* crop failed absolutely, except for a small portion in plot D.

Plot B.—Jowar was very patchy; in some places it grew to about 9 feet in height, but in other places it was only about 2 feet high. The *sann* gave a rather more even growth than the *jowar*, but as a green manure crop it was not a success, as it did not give much bulk of green stuff.

WINTER RICE EXPERIMENTS.

(*a*) *Manurial.*

(*b*) *Variety.*

(*a*) *Manurial experiments.*—These were carried out on 23 plots in the eastern ravine. The plots are of different shapes and sizes, the original bunds being allowed to remain, as any attempt to standardise the plots with regard to shape and size would have been likely to upset the evenness of the land. The plots varied in size from about $\frac{1}{8}$ to $\frac{1}{12}$ of an acre each.

The experiment, which is intended to be permanent, was carried out in duplicate, the scheme of manuring being as follows :—

(1) Green manured with *dhaincha*.
(2) Green manured with *sann*.
(3) Bonemeal, 3 maunds per acre.
(4) Ditto, *plus* saltpetre, 30 seers per acre.
(5) Ditto, *plus* sulphate of ammonia containing nitrogen=N. in 30 seers saltpetre.
(6) Ditto, *plus* calcium nitrate, containing nitrogen= N. in 30 seers saltpetre.
(7) Ditto, *plus* whole cotton seed (crushed) containing nitrogen = N. in 30 seers saltpetre.
(8) Ditto, *plus* cotton cake, containing nitrogen = N. in 30 seers saltpetre.
(9) Fish manure containing nitrogen =N. in 30 seers saltpetre.

There was also one extra] bonemeal plot and four unmanured plots.

Cotton cake, which was to have been added to bonemeal on two plots, was not available at the time, so we had altogether five plots manured with bonemeal only.

The *dhaincha* and *sann* were sown at the end of April and ploughed in the second week in July. The sann was a failure, as it died out soon after germination. The *dhaincha* grew better, but it was only about a foot high at the time it was ploughed in. The bonemeal was applied to the land at the beginning of May and the cotton seed and fish manure at the end of July, when the land was puddled. The saltpetre, sulphate of ammonia, and calcium nitrate were applied as top-dressings in the middle of September after the plants had become well established. The paddy was transplanted during the first week in August and harvested at the end of November.

Results.—As this is the first year of the experiment, I do not think we should be justified in publishing any figures. The experiment will have to be carried on for several seasons before any definite conclusions can be drawn from the results obtained.

The first year's results will naturally be influenced by the differences in the inherent fertility of the various plots. Therefore, I do not propose to give any figures or to attempt to draw any definite conclusions. The following notes, however, might be of interest :—

On the whole, bonemeal applied alone was more profitable than when a soluble nitrogenous manure was added.

There was very little difference in yield between the plots which received soluble nitrogenous manures in addition to bonemeal, but calcium nitrate gave slightly more grain and less straw than saltpetre or ammonium sulphate.

The *dhainchu* for green manure did not get a fair trial, as the growth was so poor, but the average yield of grain on the two plots was about equal to the average yield on the five bonemeal plots.

(*b*) *Variety experiment*.—The following 11 varieties were planted on $\frac{1}{10}$th acre plots for comparison. The plots were all unmanured, and the seedlings were planted singly 12" apart.

(1) Hatisal from Jorhat (Upper Assam).
(2) Manjki Madhuri from ditto.
(3) Kalajoha from ditto.
(4) Lahadong from Mymensingh (Eastern Bengal).
(5) Mailati—local.
(6) Chiniguri „
(7) Chaplash „
(8) Kartaribhog from Dinajpur.
(9) Badshahbhog from Burdwan.
(10) Dadkhani from Dinajpur.
(11) Red Balam of Bakarganj (acclimatised seed).

The experiment was a failure, as owing to dry weather there was not sufficient water in the plots. The local varieties, however, stood the drought much better than the imported varieties. The seed of the 100 best plants of each variety was harvested separately for sowing next season.

Other experiments.—The following crops were tried on small areas—ground-nut, potatoes, *thesari*, oats, and peas.

Ground-nuts were tried for the first time. About $\frac{1}{5}$th of an acre of the lightest high land soil was selected and

manured with cowdung at the rate of 150 maunds per acre. The crop was sown in the first week in May and harvested at the end of December.

The crop made good growth and produced a fair yield of nuts, but on account of the heavy nature of the soil, it was found extremely difficult to harvest them. The actual yield obtained from the plot was about 4 maunds, but probably this only represents about half the crop, as it was impossible to recover all the nuts from the soil, which had set in hard clods.

The cost of harvesting was not covered by the value of the nuts obtained, so we have decided to abandon any further attempts to grow this crop on the Dacca Farm, where the soil is obviously much too heavy.

Potatoes.—This crop was tried on a portion of the open low land, which in a normal season is cropped with, winter paddy, but which, owing to the deficient rainfall, could not be cropped with paddy. Two varieties of potatoes, Darjeeling and Nainital, were planted each on $\frac{1}{3}$th acre. The land was manured with three hundred maunds of cowdung and $13\frac{1}{2}$ maunds of castor cake per acre, and the crop was planted in the first week of November. There was no rainfall after planting, and the crop suffered from want of moisture. We were not able to irrigate before the end of January, when the Santi tank was being baled out for excavation, but the irrigation given then saved the crop from being an absolute failure. The crop was harvested in March and yielded about 70 maunds of tubers per acre. With proper facilities for irrigation, potatoes will be successful at Dacca, but any attempts to grow them without irrigation are bound to result in failure.

Oats, peas, and khesari.—These were sown on other portions of the open lowland. They germinated well, but the plants died off soon afterwards, owing to deficient soil moisture, and to the fact that there was no rainfall after September.

Non-experimental cultivation.

9. Up to the middle of November, there were only three pairs of cattle on the farm, so it was impossible to cultivate much of the land ourselves. Therefore, the whole of the reclaimed area, both high and low land, except the small portions under experiment, was let out to the surrounding raiyats, who took a crop of *aus* paddy from the high land and

winter paddy from the *holas*. The high land was let for *aus* cultivation at a rental of one rupee per *bigha*, and we tried to induce the raiyats to take the land afterwards for *rabi* cultivation at the nominal rent of annas eight per *bigha*, but after the *aus* paddy had been harvested, the land was so hard and dry that *rabi* cultivation was impossible, so practically the whole of the high land was bare during the cold weather. A few of the raiyats sowed *mung* and mustard on small portions of the land, but these crops failed for want of moisture.

The ravine land was let out for winter paddy on what is known as the "Bhag" system. About 136 *bighas* of land let out in this manner gave us about 356 maunds of paddy as our share, out of which we had to return 48 maunds to the raiyats for seed, leaving us a net return of 308 maunds.

Establishment.

10. The sanctioned establishment consists of—

1 Superintendent (Agricultural Supervisor) on Rs. 250—10—400.

2 Overseers on Rs. 30—2—50.

1 Fieldman clerk on Rs. 25—1-8—40.

1 Peon on Rs. 8.

1 Durwan on Rs. 10.

From the commencement of the year until March, Babu Kali Das Roy, Supernumerary Farm Superintendent, was in charge of the Farm. Mr. J. N. Chakravarty, Agricultural Supervisor, took over charge from him in March on his return from Pusa. Since then, Babu Kali Das Roy has been in charge of the building and surveying operations on the Farm. The Fieldman Clerk returned from Pusa in November after six months' training. He has been appointed overseer. An extra overseer has been employed since February to help with the building and surveying work. An extra Fieldman Clerk was appointed temporarily from February to assist with the office and field work. Sanction of Government is being obtained for the employment of one fieldman and one clerk instead of a fieldman clerk, as there is sufficient work in the office for a whole-time clerk.

Apprentices.—Four apprentices were appointed during the year, and it is proposed to appoint four more during the current year. The men appointed to apprenticeships are

sons of cultivators. The only educational qualification required is that they should be able to read and write Bengali. Knowledge of English is not regarded as a special qualification. The apprentices do all kinds of farm work, and are instructed in experimental work by the Farm Superintendent and the overseers. At the end of 2 years' training, if they are considered fit for the work, they will be sent out among their fellow cultivators as demonstrators. During their period of training they are paid Rs. 15 per month, but when they are appointed demonstrators, it is proposed that their pay should be Rs. 25—1-8—40 per month.

We have also a few young men, sons of cultivators, who are working on the farm as ordinary labourers for the present in anticipation of obtaining apprenticeships when vacancies occur.

Cattle.

11. The Farm had only three pairs of bullocks up till last November, when 17 pairs were purchased at Sonepur by the Veterinary Superintendent. The total cost of the 17 pairs purchased was Rs. 2,120, inclusive of freight and railway fares of attendants from Sonepur to Dacca, which works out at about 125 per pair.

Unfortunately, two of the new-bullocks fell on the slippery cement floor of the cattle-shed and injured themselves so badly that one had to be destroyed, and the other will probably never recover. At present, therefore, we have 19 pairs of bullocks capable of being worked. It is proposed to purchase 12 more pairs at Sonepur next November.

Implements.

12. At present, most of the implements in use on the farm are of the ordinary country type. In addition to these, we are using some Hindustan ploughs and are trying Planet junior hoes. During the year we imported 5 ploughs from England and one from America. These are being used almost exclusively for ploughing in green manure crops, such as *Dhaincha* and *Sann*. Descriptions of the ploughs imported, with cost, etc., are given below :—

	£	s.	d.	
Two Ransome's turn wrest ploughs, one wheel wood beam, mark B T, price	1	12	6	(Rs. 24-6) each.
Two Ditto ,, mark C T, ...	2	0	0	(Rs. 30) ,,
One Ransome's Indian iron plough with steel body, mark K.W.S., price ...	1	5		(Rs. 18-12).
One Arlington plough from U.S.A. ,,				(Rs. 26-12).

The prices given above are catalogue prices. To this the following freight and landing charges must be added :—

	Rs.	a.	p.
for 5 Ransome's ploughs	27	8	0
„ the Arlington plough	26	13	0

The Ransome ploughs, mark B.T., are easily worked by two pairs of farm bullocks, but mark C.T. (a larger size) require three pairs of bullocks to do efficient work. The smallest Ransome plough, mark K.W.S., can be worked with only one pair of bullocks, but is not so efficient as the others.

The Arlington plough has not yet been tried, but it is of a heavier type than any of the others, and will probably take three pairs of good bullocks to work it.

13. *Receipts and expenditure* for the year under report were as follows :—

Receipts.

	Rs.	a.	p.
Thatching-grass	95	14	0
Fuel	158	14	0
Agricultural produce	1,245	0	8
Rent of land	184	14	9
Rent of grazing	51	11	0
Miscellaneous	14	2	3
Total ...	1,750	8	8

Expenditure.

Establishment	4,906	1	11
Capital charges—			
Buildings constructed departmentally, including a culvert	4,219	9	6
Excavation of tanks	3,496	8	0
Reclamation of land	1,982	15	0
Roads, drains, etc.	278	0	0
Live stock	2,120	9	3
Implements	933	15	11
Total ...	13,086	9	8

Non-capital charges—

	Rs.	a.	p.
Labour	5,879	7	10
Purchase and repairs of country implements	474	6	6
Building repairs	323	3	10
Manures	369	8	6
Seeds and plants	244	11	2
Cattle food	793	6	4
Stamps and telegrams	48	2	0
Miscellaneous	272	5	3
Total ...	8,407	13	5
Grand total ...	28,151	1	8

APPENDIX.

Crops on the ground at the close of the year (June 30th, 1909) and proposed cropping scheme for the Rabi Season.

It has already been explained in the report to which this is an appendix, that, since the high land is so uneven, and thus useless for comparative experiments at present, it is proposed to crop it evenly in large blocks as far as possible, with the object of levelling it up.

Further, with the object of testing our progress in this respect by actual weighments, we are having the blocks of land laid out in *bigha* plots. The plots will be numbered, and the produce of each plot will be weighed separately. There will be no actual divisions between the plots, but pegs will be placed round the boundaries of the blocks of land, so that at harvest time, by drawing lines between pegs on opposite boundaries, we shall have the whole area laid out in square *bigha* plots. The work of laying out the land in this way is proceeding, and we hope to commence this system of weighment on the next *rabi* crops.

The case is different with the low-lying ravine lands. These have been cropped with winter paddy for generations, with the result that the land is comparatively even in character. It is therefore not proposed to disturb any of the old bunds, but an attempt will be made to test the

uniformity of the original plots by weighing the produce of each plot separately as far as practicable.

High land cropping.

2. Since the high land is so poor in organic matter and so unretentive of moisture, it was resolved to try a course of green manuring to remedy these defects. Therefore, the whole of the North and South Hazi and Mastul blocks, the greater part of the Santi block, and the west Shoti block, with the exception of the portion under experiment, have been sown with *Dhaincha* for green manure. The greater portion of the East Shoti block has been sown with *Sann*, also for green manure. The Agirgaon block, which was only partly under cultivation last year, has been sown with *aus* paddy. The newly-reclaimed portions of the Mirpur block (Mirpur central and south) have also been put down in *aus* paddy. North Mirpur field has been sown with mixture of *Rahar* and Maize, as this land is somewhat different from the other portions of the block having been under cultivation some time previously. The Maize will be harvested when ripe, and the *Rahar* will occupy the land throughout the *rabi* season.

The whole of the office field is carrying a crop of *jowar* for cattle fodder.

The question of the *rabi* cropping was rather difficult to decide. Local enquiries showed that only three crops, *viz.*, *Til*, *Mung*, and *Matikalia* are likely to be successful on this class of land. We therefore decided to put the bulk of the high land area under those three crops, and to try a few other crops on a much smaller scale. Consequently, all the high land now under *Dhaincha* and *Sann*, for green manure, will be sown with *Til*, except the North Hazi block, on which mustard (local *Sersu*) will be tried. The two portions of the Mirpur field, now under *aus* paddy, will be sown with *Matikalia*, and the whole of Agirgaon field, which is also under *aus* with *Mung*. The greater portion of the office field now under *jowar* will be sown with *matikalia*, but on a small portion, near the farm buildings, which is of better quality, having been *basti* land, mustard will be tried.

Other crops which will be tried on small areas are linseed, oats, wheat, and peas.

It is proposed to try a small inoculation experiment on peas and oats with cultures of bacteria obtained from England

The experiment in West Shoti on the improvement of the high land will be continued according to the scheme detailed in the report.

A small area near the Shoti Tank has been planted with sugarcane (local *Ganderi* variety) for trial. It is doing well so far, and it is quite possible that a considerable portion of the high land will be found suitable for this crop. If the crop is a success this year, we shall put down a larger area next season.

We have also arranged to put down about half an acre of Rhea for trial. Cuttings are being sent from Behar by the Fibre Expert.

Open low land cropping.

3. The bulk of the open lowland is in the Santi field, but there is also a small area round the Hazi tank and in the northern portion of the Mastul field.

This was all sown with *Dhaincha* for green manure to be followed by non-experimental paddy.

Ravine land cropping.

4. About two acres in the Khoshkhana ravine is now under jute, which will be followed by winter paddy.

The series of manurial experiments on winter paddy in the Eastern Ravine will be repeated, and another manurial experiment has been laid down in duplicate in the southern portion of the Khoshkhana ravine, to contrast the effect of cowdung and green manure on winter paddy.

In the Jalabisra ravine, a series of 12 plots has been selected for a planting and spacing experiment with winter paddy. The paddy seedlings will be planted at 8″, 10″, and 12″ apart, with one, two, three, and four seedlings in a hole. The experiment is being duplicated in the Telbasra ravine.

To the south of the planting experiment in the Zalabisra ravine is a small cultivation experiment with winter paddy. Duplicate plots will be planted with paddy and then treated as follows:—

(1) *Khesari* to be sown before the paddy is harvested.

(2) Land to be ploughed up immediately after the paddy is harvested.

(3) Land not to be ploughed until the following rains.

The effect of the various treatments will be noted on the following season's paddy crop.

Several varieties of paddy will be grown side by side for comparison, and the Economic Botanist will probably use them as a basis for selection work.

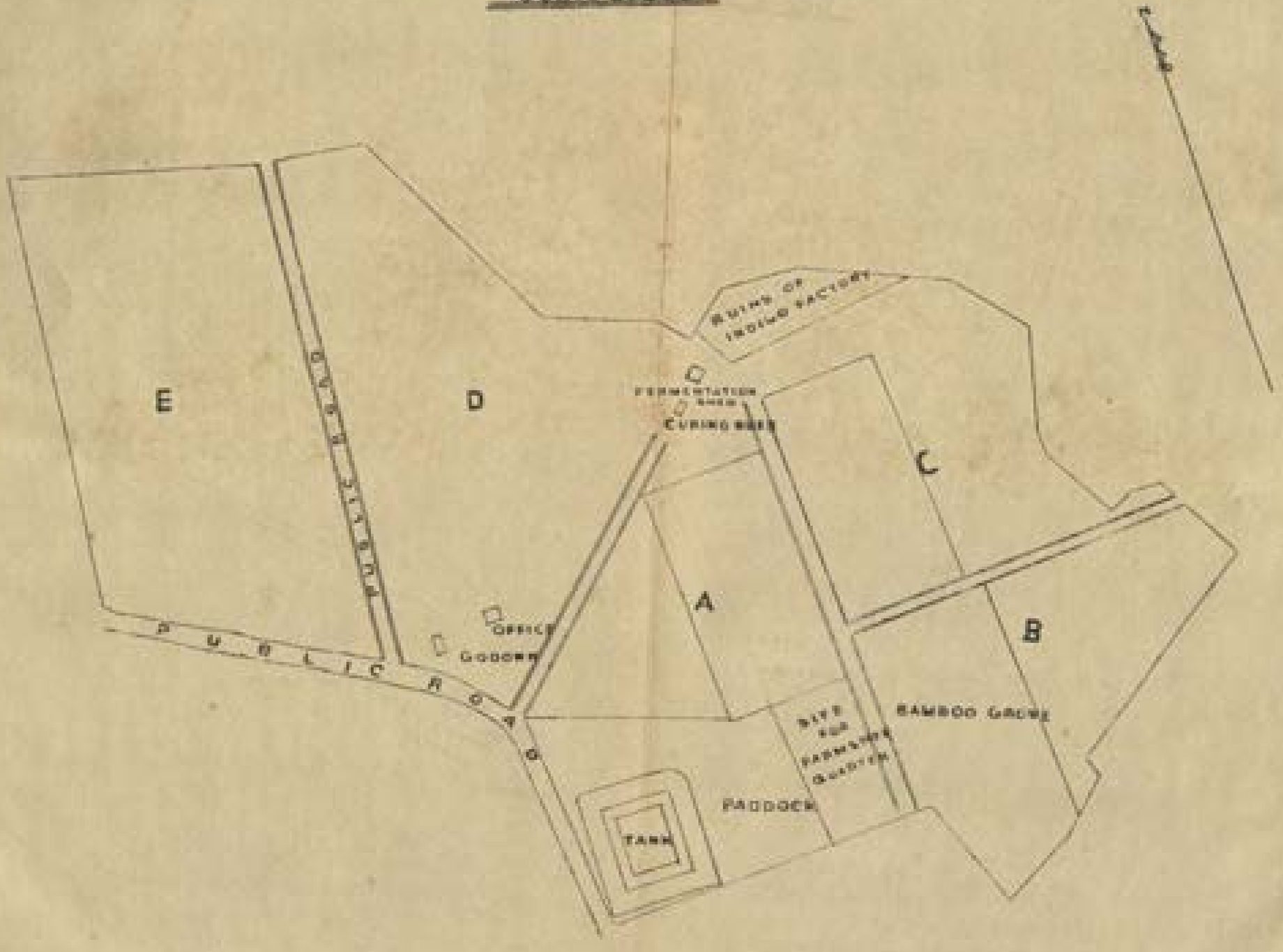
The remainder of the ravine land will be cropped with several of the best local varieties of winter paddy without manure.

A. G. BIRT,

Supernumerary Agriculturist,

Eastern Bengal and Assam.

MAP
OF
BURIR-HÁT FARM
Scale 200 ft.



Annual Report of the Burirhat Agricultural Station for the year ending the 30th June, 1909.

Introductory.

THE Farm, which is intended principally for experimental tobacco cultivation, is situated about five miles north of Rangpur town, and is about 52 acres in area. The land was acquired in 1907, but no establishment was kept there until the end of August 1908, when the Rangpur Farm establishment removed to Burirhat. A certain amount of preliminary work, such as jungle clearing, building, and road making, had been done, but the real work of the station was not commenced until the establishment had removed there.

Distribution of land.

2. The farm occupies an irregular-shaped piece of land split up by roads into five main blocks, lettered A, B, C, D, and E (*vide* plan). There is also a small area set apart for a paddock and for the Farm staff quarters. Block E is completely isolated from the rest of the Farm by a public right-of-way which had to be kept open, so this block is being fenced separately.

Soil.

3. The soil is a sandy loam, with a subsoil of almost pure sand, which occurs at a depth of from 1 to 2 feet from the surface. Three samples of soil, and three of subsoil have been sent to Pusa for analysis, but the results have not been received yet.

Buildings.

4. The Farm is equipped with a tobacco-curing house a fermentation house, an office and a godown. It is proposed to build permanent quarters for the Farm staff during the current year. Another curing shed is needed, but this will have to wait until more funds are available. The cattle are at present housed in temporary bamboo structures. It is not proposed to build an extensive *pucca* cattle-shed. The cattle do very well in their present quarters, but they will have to be removed shortly to a site within the paddock, where a shed for them will be built with bamboo mat or split bamboo walls and a thatched roof. The building will not cost more than about Rs. 200.

5. The season was an abnormally dry one, as will be seen from the following table of rainfall :—

Weather.

Month.	Actual.		Normal.	
	Rainfall in inches.	Number of rainy days.	Rainfall in inches.	Number of rainy days.
1	2	3	4	5
1908, April	2·66	4	3·16	4·3
„ May	3·85	13	10·37	11·1
„ June	14·72	14	19·95	15·7
„ July	10·37	12	15·93	15·4
„ August	4·84	13	13·02	13·3
„ September	15·68	16	14·18	13·5
„ October	0·67	2	4·94	4·0
„ November	...	...	0·24	0·1
„ December	...	...	0·08	0·2
1909, January	...	...	0·49	0·0
„ February	0·02	2	0·43	1·1
„ March	...	...	1·6	1·6
Total	52·81	76	83·95	81·2

The season was very unfavourable for the *rabi* crops, as there was practically no rainfall while they occupied the land. The heavy rainfall in September spoilt a lot of young tobacco-seedlings in the district.

6. At the commencement of the year the only land which had been broken up was block A, a portion of block C, and the whole of block B. Of the remainder of the Farm, blocks D and E were grazing lands and a portion of block C was under grass and scrub jungle. The portions already broken up were put under *rabi* crops, and all the rest of the land was cleared and ploughed up ready for cropping in the following spring.

Work done during the year.

A wire fence was erected by the Public Works Department

round the larger area comprising blocks A, B, C, and D and the paddock, and we have in hand now the fencing of block E, and also two sides of the paddock.

The following crops were grown :—

1. Tobacco.
2. Oats.
3. Mustard.
4. Potatoes.
5. Cow-peas (for green manure).

These will be treated separately in the following paragraphs :

7. The following table gives particulars of the varieties of tobacco grown on the Farm during the year. Seven varieties were tried for the first time, *viz.*, Pennsylvania, stemmed Orinoco and Little Flannigan from America, three varieties from Jalpaiguri and one from Chittagong; the other varieties had been grown on the Rangpur Farm in the previous year :—

Tobacco.

Serial No.	Class of tobacco.	Variety.	Source of seed.	Area in acres.	Rotation.	Manure per acre.	Time of transplanting.	Date of commencement of harvest.	Mode of harvesting.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
		Sumatra—								
1	Cigar leaf tobacco, exotic.	(1) Grown under shade	From grown seeds.	0·05	Grazing land	Nil.	31st Oct. & 1st Nov.	...	.....	Failed.
		(2) „ in the sun ...	Ditto ...	·10	Ditto ...	Nil.	28th Oct. to 1st Nov.	15-2-1909	Basal leaves plucked, rest cut whole.	
		(3) Green manured ...	Ditto ...	·57	Green manure.	Green manured with cow pea.	5th Nov. to 17th Nov.	4-2-1909	Ditto.	
		(4) Grown from selected seed.	Saved under glass frame.	·10	Grazing land.	Nil.	27th Oct. to 1st Nov.	15-2-1909	Ditto.	
2		(1) Havana ...	Farm seed ...	·10	Ditto ...	Nil.	7th Nov. ...	8-2-1909	Ditto.	
		(2) „ selected ...	Saved under glass frame.	·10	Ditto ...	Nil.	31st Oct. to 7th Nov.	4-2-1909	Ditto.	

	.....	Connecticut seed leaf...	Farm seed ...	·10	Ditto ...	Nil.	30th Oct. to 4th Nov.	1-2-1909	Ditto.		
4	.....	Pennsylvania ...	Imported from America.	·10	Ditto ...	Nil.	4th Nov. to 7th Nov.	3-2-1909	Ditto.		
5	Local Rangpur varieties.	(1) Bhengi ...	Farm seeds ...	·10	Ditto ...	1½ mds. saltpetre per acre.	31st Oct. to 7th Nov.	...	.....	Failed.	
		(2) Ditto ...	Ditto ...	0·25	Ditto ...	Nil.	26th Nov. ...	3-4-1909	Basal leaves plucked, rest cut whole.		
		(3) Mana Bhengi ...	Ditto ...	·10	Ditto ...	Nil.	31st Oct. to 7th Nov.	28-3-1909	Half the crop cut whole, the other half primed.		
		(4) Naokhol ...	Ditto ...	·10	Ditto ...	Nil.	Ditto ...	27-3-1909	Ditto.		
		(5) Sinder Khatna ...	Ditto ...	·10	Ditto ...	Nil.	Ditto ...	4-3-1909	Ditto.		
6	Jalpaiguri varieties.	(1) Kulapati ...	From Jalpaiguri.	0·25	Ditto ...	Nil.	12th Nov. ...	4-4-1909	Basal leaves plucked, rest cut whole.		
		(2) Matipaya ...	Ditto ...	·05	Ditto ...	Nil.	18th Nov. to 22nd Nov.	3-4-1909	Ditto.		
		(3) Halikari (appears to be Matibari).	Ditto ...	·10	Ditto ...	Nil.	9th Nov. to 15th Nov.	27-3-1909	Ditto.		

Serial No.	Class of tobacco.	Variety.	Source of seed	Area in acres.	Rotation.	Manure per acre.	Time of transplanting.	Date of commencement of harvest.	Mode of harvesting.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
		Brought forward ...		1·62						
7	Chittagong variety.	Matamouri ...	From Chittagong.	·10	Grazing land.	Nil.	29th Oct to 7th Nov.	27-3-1909	Basal leaves plucked, rest cut whole.	
8	American cigarette tobacco.	(1) Stemmed, Orinoco	Imported from America.	·10	Ditto ...	Nil.	30th Oct. to 12th Nov.	22-2-1909	Ditto.	
		(2) Ditto ...	Ditto ...	·05	Ditto ...	Nil.	9th Nov. ...	27-3-1909	Ditto.	
		(3) Little Fleminger...	Ditto ...	·10	Ditto ...	Nil.	30th Oct. to 8th Nov.	12-2-1909	Ditto.	
		(4) Ditto ...	Ditto ...	·05	Ditto ...	Nil.	9th Nov. ...	27-3-1909	Ditto.	
9	Turkish cigarette tobacco.	(1) Cavalla ...	Farm grown seed originally imported from Garce.	·10	Ditto ...	1½ mds. saltpetre per acre.	27th Oct. to 3rd Nov.	4-2-1909	Priming.	
		(2) Sari	.....	·10	Ditto ...	Ditto ...	28th Oct. to 3rd Nov.	4-2-1909	Ditto.	
		(3) Scented leaf ...	.....	·10	Ditto ...	Ditto ...	29th Oct. to 4th Nov.	5-2-1909	Ditto.	
			Total ...	2·52						

The crop, with the exception of about half an acre of Sumatra grown on land which had been green manured with cowpeas, did very badly. The greater portion of the crop was grown on land in Block A, as the first crop after old pasture. The land was not manured, as it was thought that this old grazing land would be sufficiently fertile to give us a good crop, and at the same time would probably turn out better-quality tobacco than land heavily manured. Our expectations, however, were not realised. Owing to drought and poverty of the soil the crop was almost a failure. Subsequently, a small area was top-dressed with 1½ maunds of saltpetre per acre and irrigated, but this had very little effect on the growth.

Curing.—Sun-curing was tried with the following varieties —Orinoco, Sindur Khatna, Mana Bhengi, and Naokhol, but the experiment was not very successful. The high dry west winds at this time of the year, alternated with misty weather, are against outside curing at Rangpur. The cigar-leaf tobaccos were cured in the curing-shed, the best results being obtained with the half acre of Sumatra which was grown on the green-manured plots. The weight of cured leaf from this plot was 6 maunds.

Selection of seed.—As in previous years, selected plants of each variety were allowed to flower, and the flower-heads were enclosed with glass-frames. The seed of these selected plants was preserved separately for sowing next season.

Samples for valuation.—Mention was made in last year's Rangpur Farm Report of a number of samples of our tobacco sent to London for examination by tobacco dealers and manufacturers. Reports on these samples have recently been received, and, to say the least, they are not encouraging. The dealers are of opinion that none of the samples would find a place on the European market, and they state that all the tobaccos have an earthy flavour, which may be due to unsuitable soil or climate.

On handing over charge to the Assistant Director of Agriculture my connection with the Burirhat Farm, and therefore with tobacco work in this Province, ceases. But there are a few things which I should like to point out in connection with the tobacco work which require serious consideration by the Agricultural Department.

The position with regard to tobacco in the Rangpur district is briefly as follows:—At present the tobacco-growers in the district confine their attention solely to the produc-

tion of coarse tobacco suitable for smoking in the hookah. Their object is to produce a heavy crop, and to attain this, they manure heavily with cowdung and any organic refuse available. The resulting tobacco is extremely coarse, and contains a high percentage of nicotine. The tobacco so produced is bought up by Burmese merchants who visit the district at the time of harvesting the crop. The tobacco is partially cured by the cultivators before being sold to the merchants, who ferment it in stacks in huge central godowns built in the heart of the tobacco-growing tracts. After fermentation, the tobacco is exported to Burma, where it is made up into big cigars for native consumption. The cultivators get from Rs. 10 to Rs. 25 per maund for the cured tobacco, and in a good season the yield is from 15 to 20 maunds per acre.

The Agricultural Department of Bengal commenced experiments with local and exotic varieties of tobacco on the Rangpur Farm in 1905, and since the creation of the new province the work has been carried on by this Department. The principal object aimed at has been the production of tobacco of a quality suitable for the manufacture of good class cigars and cigarettes. The improvement of the local tobacco for the particular object for which it is grown is hopeless, and I don't think it was ever contemplated.

Now, although we have experimented for several years with most of the best foreign varieties grown, we have never produced anything which a firm manufacturing high class cigars and cigarettes will touch. Samples have been sent to England several times, but practically all the reports have been to the same effect, *viz.*, that they can make no use of our tobacco, and they hint that the samples must have been grown under unfavourable conditions of soil and climate.

The cultivator at present makes a very good profit on the coarse local tobacco, of which he gets a heavy crop. Now, since under a system of cultivation and manuring calculated to produce a finer and better quality of tobacco, the yield will probably be less than that obtained by the cultivator, it follows that the price per maund of the better quality tobacco will have to be considerably higher than that of the local tobacco, in order to pay as well as the local tobacco. For this reason, it will probably be necessary to command for the finer tobaccos at least double the price

which is at present obtained for the local coarse tobacco before we can advise the cultivator to take up the cultivation of the better-class tobaccos. But so far we have failed even to touch the top price of the local coarse tobacco with our exotic varieties, in fact there is no market at present for them.

In view of the above facts, I am strongly of opinion that the Department should pause and consider on what lines future work should continue. If it is decided to go on with the work, I consider that it will be absolutely imperative to secure the advice of a thoroughly practical and experienced tobacco-growing expert.

Oats.

8. This crop was tried on about 2¼ acres on block A. The land was old pasture broken up during the rains. Two varieties were sown —local and Hissar (seed obtained from United Provinces). The land was not manured, and both varieties grew luxuriantly on certain portions of the land, whereas on other parts the growth was extremely poor, showing up the unevenness of the land. The yield of grain was 10½ maunds of Hissar from one acre and 10½ maunds local from 1¼ acres (8½ maunds per acre). On the parts where the crops grew best, the yield of both varieties would not be less than about 20 maunds per acre.

Mustard.

9. One acre Raipur variety and 1·4 acres local variety were grown on block C. The land had been levelled recently, and the crop was very uneven. In some places, both varieties grew well and yielded a good crop, but in other places there was no crop at all.

Potatoes.

10. Three varieties, *viz.*, Silbilaiti (local), Nainital, and Darjeeling, were grown on half an acre in block C. The land was manured with 150 maunds of cowdung per acre. The result was not good owing to the long drought. The local variety gave 105 maunds, Darjeeling 50 maunds, and the Nainital 29 maunds per acre. The Nainital and Darjeeling varieties did not germinate well, and were attacked with brown rot; but, given a normal season and more manure, I should think potatoes are likely to be a success on this soil.

Supply of seed.

11. The following seeds were distributed from the Farm during the year :—

Tobacco—			
Pennsylvania	...	...	½ oz.
Local varieties	...	...	2½ „
Cavala ...	...	...	3 srs. } To the Rangpur
Scented leaf	...	...	3 „ } Tobacco Company.
Sugarcane—			
Vandamukhi	...	...	3,000 cuttings.
Potatoes—			
Patna from Darjeeling		...	6 mds.
Nainital	...	...	32 „

Receipts and expenditure.

12. During the year the receipts amounted to Rs. 306-3-9 and the expenditure to Rs. 8,153-15-4, including Rs. 2,986-2-6 for establishment and Rs. 1,826-2-0 for capital charges.

Establishment.

13. The establishment consists of a Farm Superintendent on Rs. 100—10—200, a fieldman clerk on Rs. 25—1-8—40 and a peon on Rs. 8. A cigar-roller was employed up to March 31st, when his services were dispensed with.

Inspection.

14. The Farm was inspected once by the Director of Agriculture and five times by the Officiating Assistant Director during the year.

The Collector of Rangpur, Mr. Vas, also paid several visits to the farm.

APPENDIX I.

Cropping Scheme for Kharif, 1909, *and Rabi*, 1909-1910.

To prepare the land for future experiments each block will be divided up into *bigha* plots in the same way as at Dacca, and cropped uniformly until an approximately equal state of fertility is obtained.

Blocks A and C have been cropped with cow-peas for green manure, to be followed by mustard on block A and by tobacco and potatoes on block C. Block B has been

sown with *jowar* for cattle fodder. Blocks D and E were newly broken up last spring. Block D has been cropped with *aus* paddy without manure, to be followed by a leguminous crop—*matikalai*. Block E is being green manured with *dhaincha*, to be followed by oats for the *rabi* crop.

One acre of Sumatra tobacco and half an acre of the local *Bhengi* variety will be put down to provide material for curing experiments next season. The exact nature of the curing experiments is not yet decided. Most of the other local and exotic varieties which were grown last year will be planted on small plots from 1-10th to 1-20th acre in area. The total area under tobacco will be about 2½ acres.

A small plot of ground-nut is also being grown for trial.

APPENDIX II.

Crops on the ground at the time of handing over the Rangpur Farm to the local Agricultural Association.

1. *Ginger.*—The following four varieties were grown on 1-10th acre plots side by side Cochin, Calicut, Jamaica, and local. All the varieties were attacked by a fungus disease (*Pythium Gracile*), which was prevalent in the district. The disease is under investigation by Mr. McRae, Supernumerary Mycologist, Pusa.

2. *Ground-nut.*—This crop is new to the district, and was grown this year for the first time on about 1-5th of an acre. It grew well at first, but when the rains came on it was attacked so badly by disease that the new management ploughed it in. This disease is also being investigated.

3. In addition to the above crops, there was about 1-5th acre of *dhaincha* for green manure, 2½ acres of *aus* paddy, 1-3rd acre of *jowar* and 1-5th acre of maize.

MAP
OF
RAJSHAHI FARM
scale 16 inch = 1 mile

ROYAL ASIATIC SOCIETY
LIBRARY

Annual Report of the Rajshahi Agricultural Station for the year ending the 30th June, 1909.

Introduction.

The farm, which has been in existence since 1904 and was handed over to this province at the time of the partition of Bengal, is situated just outside the town of Rampur-Boalia. Its total area is 63 acres, of which about 50 acres is under cultivation.

Soil.

2. About half of the land is low enough for the growth of the winter paddy, while the remainder is high land suitable for the ordinary dry crops of the district. The soil of the low land is stiff, while that of the high land varies from sandy loam to loam. The land had been under cultivation for a long time before it was acquired for an experiment station. Analyses made by Dr. Leather of several samples of soil from different parts of the farm indicate that the amount of available phosphates and potash is low, but there is an abundance of lime in the soil.

Distribution of land and plots.

3. On a reference to the plan attached to this report it will be seen that the farm is divided into four main blocks (A, B, C and D) by the two chief roads which cross at right angles. The two southern blocks, A and B, have been subdivided into plots each $\frac{1}{5}$ of an acre in area. Block A consists almost entirely of low land, and is reserved for experiments with winter rice. The whole of block B is high land and here the sugarcane experiments are carried out. A piece of land in the north-east corner of this block has been reserved as a site for the farm staff quarters. Block C is for the most part high land, but there is a small area suitable for winter paddy. A portion of this block has been left under grass to provide grazing for the bullocks and the remainder is divided into six plots each $1\frac{1}{5}$ acres in area. Block D consists of both high and low land. The soil of this block is stiffer than most of the other land on the farm and grows good crops of wheat and gram. There is a small tank which has recently been deepened at a cost of Rs. 120 and is now used for steeping jute.

Buildings.

4. At present the only pucca building on the farm is a godown of corrugated iron which was completed at the beginning of the year under report. During the current year we propose to erect

quarters for the farm staff, an office and a new cattle-shed. The cattle shed will be erected on the grazing land in the north-east corner of block C, and about a bigha of land surrounding it will be fenced in to form a yard for the cattle. A pucca well with a masonry trough will be sunk in the cattle yard. We have abandoned the idea of a pucca cattle-shed and have decided to erect a bamboo structure with thatched roof of a type superior to that of the surrounding cultivators, but which might be copied to advantage by some of the better class cultivators. The cost of this shed for 10 pairs of cattle will not exceed Rs. 200.

5. The following table gives the rainfall during the growth of the crops under report, side by side, with the normal rainfall of the district :—

Month.	Actual.		Normal.	
	Rainfall in inches.	Number of days on which rain fell.	Rainfall in inches.	Number of days on which rain fell.
1	2	3	4	5
1908 April	0·06	1	1·81	2·9
May	4·56	8	5·56	7·7
June	9·49	14	10·81	12·6
July	4·57	16	11·45	15·1
August	7·23	18	10·75	14·7
September	4·89	8	10·40	12·4
October	1·16	4	4·46	4·9
November	Nil	Nil	0·31	0·6
December	Nil	Nil	0·06	0·2
1909 January	Nil	Nil	0·34	0·8
February	Nil	Nil	0·34	1·3
March	Nil	Nil	1·15	1·6
Total	31·96	99	57·94	74·8

As will be seen from this table, the rainfall was greatly in defect. The shortage in rainfall completely upset our arrangements for planting winter rice, as there was never sufficient water in the fields. The rabi season was extraordinarily dry, no rainfall being recorded from the 13th October 1908 till the end of March 1909. However, there was sufficient moisture in the soil for the germination of the rabi crops which did fairly well in spite of the fact that they had to depend entirely on soil moisture, as no rain fell during their growth.

Programme of experiments.

6. The programme of experiments was extensive and included :—

1. Winter rice experiments—
   (*a*) Variety tests with coarse and fine varieties.
   (*b*) Manurial.

Bonemeal *versus* bonemeal and saltpetre, green manured with Dhaincha *versus* no manure.

2. Sugarcane experiments—
   (*a*) Variety.
   (*b*) Manurial.
3. Jute experiments—
   (*a*) Manurial.
   (*b*) Rotation.
4. Wheat experiments—
   (*a*) Variety.
   (*b*) Manurial.
5. Potatoes—manurial experiment.
6. Groundnuts—as a new crop.

The experiments with winter rice could not be carried out as there was no water in the fields at the time the crop should have been transplanted. All the other experiments however were carried out and they are dealt with in the following paragraphs.

Sugarcane—Variety experiment.

7. This was a continuation of last year's experiment, when the two varieties—Dacca Ganderi and local Khagri were compared; but this year another variety, Samsara, from the Burdwan district, was included.

Three ⅕ acre plots (Nos. 84, 85 and 86 in block B) were taken for this experiment. Each plot was divided into three equal parts on which the varieties were planted side by side. The experiment was thus carried out in triplicate on $\frac{1}{15}$ acre sub-plots, the total area under each variety of cane being ⅕ acre. Before planting the sets the whole of the land was manured with 300 maunds of cowdung per acre ploughed in. In addition to this the crop was top-dressed in August with 24 maunds of castor-cake per acre.

The sets were planted at the beginning of February in furrows 1 foot wide and four feet apart from centre to centre, with a double line of sets placed alternately in each furrow. The number of sets per acre was 11,550.

The percentage germination of sets varied considerably. Whereas all the sets of local Khagri germinated, the percentage germination of Dacca Ganderi was 83·8 while that of Samsara was only 55·3.

All the varieties suffered from the prolonged drought which set in from October, and a certain amount of damage was done by white ants and rats. The cane was harvested in the latter part of January 1909. At the time of harvest the plots of local Khagri and Dacca Ganderi appeared to be fairly even in growth, but Samsara did not show such uniformity. This was probably due to the fact that Samsara was damaged more by white ants than the other varieties.

The results are set out in the following tables. Table I compares the outturn and profit from Dacca Ganderi and local Khagri in the two years 1908 and 1909, and gives this year's results with Samsara. Table II was compiled by the Agricultural Chemist, Mr. Meggitt, from analyses of the juice which he made while crushing was proceeding.

TABLE I.

Per acre.

Variety.	1908.							1909.						
	Cane, crushable.	Juice.	Percentage of juice.	Gur.	Value of gur.	Expenditure.	Profit.	Cane, crushable.	Juice.	Percentage of juice.	Gur.	Value of gur.	Expenditure.	Profit or loss.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Mds.	Mds.		Mds.	Rs.	Rs.	Rs.	Mds.	Mds.		Mds.	Rs.	Rs.	Rs.
Dacca Ganderi ...	776	617	79·5	98½	492	233	259	840	725	86·4	103	515	282	233
Local Khagri ...	512	382	74·6	54½	272	201	71	712	480	67·4	62½	311	220	91
Satusara	Not grown							345	230	66·4	41½	208	234	28 loss.

In the above table the average of two plots only is given for the Ganderi cane of 1909, as most of the cane on the third plot was taken for sets. In all other cases the average of three plots has been given.

In calculating the profit, the value of the gur has been taken as Rs. 5 per maund, and the expenditure includes actual cost ofcultivation, manuring, crushing and boiling, etc., but not rent and supervision.

TABLE II.

Variety.	Juice.		Glucose ratio.	Per acre.		
	Sucrose. %	Invert sugar. %		Sucrose.	Invert sugar.	Total sugar.
1	2	3	4	5	6	7
				lbs.	lbs.	lbs.
Dacca Ganderi ...	12·41	3·04	24·4	5,824	1,808	7,632
Local Khagri ...	9·67	2·30	23·3	3,883	905	4,788
Samsara	14·66	1·77	12·0	2,832	342	3,174

In this table also the average of only two plots of Ganderi is taken for the reason already stated.

"Glucose ratio" = parts of invert sugar to every 100 parts sucrose in juice.

The first thing that strikes one on going through the above tables is the abnormally high percentage of juice in this season's Ganderi cane. The figure 86·4 is highly improbable, and I think we may as well dismiss it at once as being due to an error in the weighment of juice. This being so, we must also leave out of consideration the total amounts per acre of *sucrose*, *invert sugar*, and *total sugar* of Ganderi cane in Table II, since these have been calculated from the weight of juice. Then in Table II the percentages in invert sugar in the juice of the Dacca Ganderi and local Khagri varieties is extremely high. Mr. Meggitt is of opinion that the cane was not ripe at the time of crushing, and also that probably fermentation of the juice had set in before analysis. Either of these things would account for the high percentage of invert sugar. In view of the above facts, we must leave out of consideration all the figures calculated from the weights of juice and the analyses and base our conclusions entirely on the outturn of gur.

On reference to table I it will be seen that in both years the Dacca Ganderi variety has shown a marked superiority over the local variety in outturn of gur, although its germination was only 83·8 per cent. against 100 per cent. in the local variety in 1909.

The Samsara variety shows up badly against the other two varieties, but this is probably due to the fact that this is its first year on the farm, the sets having been brought from Burdwan. Next year we shall plant sets grown on the Farm when we hope for better results.

The local Khagri variety is a hard, thin cane, resistant to disease, drought and the attacks of animals. It can be grown successfully on land which goes under water in the rains.

An idea of the disease and insect-resisting qualities of the three varieties of cane can be got from the following figures, which show the weights of cane which was unfit for crushing owing to the attacks of disease and white ants.

			Mds.
Dacca Ganderi, total 2 plots,	624 lbs.	per acre	57
Local Khagri, total 3 plots,	349 „	„	21
Samsara, total 3 plots	828 „	„	50½

It will be seen that the local variety easily comes out first. This fact, as also the fact that the local variety gives a very high percentage germination, will have to be taken into account when recommending the substitution of Dacca Ganderi for the local Khagri in the district; but there seems to be no doubt at present that, given a normal season and sufficient protection, the Ganderi variety would be much more profitable than the local variety on high land in the district similar to that of the Rajshahi Farm.

However, before recommending it to cultivators, we are finally testing it on a larger scale against several other varieties of cane (including the local variety) under conditions of cultivation and manuring similar to those employed by the local raiyats.

Sugarcane.—manuring experiment.

8. This experiment is intended to test the effect of the following systems of manuring on the sugarcane crop :—

1. Cowdung	...	300 mds.	per acre.
2. Cowdung	...	300 „	„
Castor-cake	...	24 „	„
3. Cowdung	...	300 „	„
Superphosphate	...	6 „	„
Saltpetre	...	2 „	„

This is the third year of the experiment. The first year's results were not reliable, as the crop was damaged by wild animals (pigs and jackals). We may, however, be able to draw some conclusions from the last two years' results taken together.

In the year under review plots 87, 88 and 89 in block B were taken for the experiment and subdivided as described in the variety experiment. Thus the experiment was carried out in triplicate, the total area of cane under each system of manuring being $\frac{1}{3}$ acre.

The local Khagri variety of cane was used throughout the experiment, and the manures were applied as in the variety experiment, the cowdung being ploughed into the land before planting and the castor-cake, superphosphate, and saltpetre applied as a top dressing to the cane.

The following table gives the results of the two years side by side. For 1908 only one series of plots has been taken as the other two series were badly lodged. In 1908-1909 also there was some damage by lodging and white ants, but it is difficult to single out any of the series for rejection without rejecting them all, so I am giving the results of all three series for what they are worth.

Per acre.

Number.	Manuring.	1908. Yield of gur.	1908. Increase over plot 1, Gur.	1908. Value of increase.	1908. Cost of additional manure.	1908. Profit or loss on additional manure.	1909. Yield of gur.	1909. Increase over plot 1, Gur.	1909. Value of increase.	1909. Cost of additional manure.	1909. Profit or loss on additional manure.
1	2	3	4	5	6	7	8	9	10	11	12
		Mds.	Mds.	Rs. a.	Rs. a.	Rs. a.	Mds.	Mds.	Rs. a.	Rs. a.	Rs. a.
1	300 maunds of cowdung ...	50¾	...	...	...	...	40½	...	...	...	...
2	300 „ „ ... 24 „ castor-cake ...	55½	4¾	22 8	60 0	37 8	40½	¼	1 4 (decrease).	60 0	61 4 (loss).
3	300 „ cowdung ... 6 „ superphosphate 2 „ saltpetre ...	59½	8¼	43 12	31 14	11 14	40¾	¾	1 4	31 14	30 10 (loss).

Castor-cake is charged at Rs 2-8 per maund, superphosphate at Rs. 3-13, and saltpetre at Rs. 7-8 per maund. I believe that castor-cake is now selling much cheaper at Rajshahi, but the figure of the previous year has been kept for the sake of uniformity.
The gur is valued at Rs. 5 per maund.

As will be seen from the table, the figures for the year under report are of little value, since the yield of gur in each case is practically the same. Even if, owing to the dry season, the castor cake did not decompose, the soluble manures should have shown some effect.

However, taking the results of the two years together, it appears that neither castor-cake nor superphosphate and saltpetre in the above quantities in addition to cowdung will pay, at any rate, on the local variety of sugarcane.

Jute experiments.

9. These were made under the direction of Mr. Finlow, the Fibre Expert. There were two experiments—

1. Manurial.
2. Rotation.

The manurial experiment was designed to compare the effects of 30 lb. nitrogen in cowdung with the same amount of nitrogen in castor-cake. Plot 120, block C, was taken and divided into six equal parts, each $\frac{1}{5}$ acre in area. Duplicate plots were manured as follows :—

1. 107 maunds cowdung per acre,
2. $5\frac{1}{2}$ maunds castor-cake per acre,
3. No manure.

The cowdung containing 0·34 per cent. nitrogen and the castor-cake 6·59 per cent. nitrogen.

Corchorus olitorius jute was sown on May 12th. The germination on all the plots was good, but afterwards there was a little water-logging round the edges of some of the plots which affected the growth of the crop in those parts. The crop was harvested during the first two or three days in October. It was intended to take a crop of winter paddy from the land afterwards, but the jute came off too late and there was no water, so mustard was sown as the rabi crop.

The results of the experiment are given in the following table :—

Plot.	Treatment per acre.	Fibre per acre.					
		Series I.		Series II.		Average.	
1	2	3		4		5	
		Mds.	srs.	Mds.	srs.	Mds.	srs.
1	30 lb. nitrogen in cowdung ...	5	16	9	7	7	11
2	30 lb. nitrogen in castor-cake ...	8	26	10	24	9	25
3	No manure	5	21	6	16	5	38

(2) *Rotation experiment.*—This was arranged to test the following two systems of rotation :—

	I.	II.
Kharif, 1908 ...	Jute ...	Jute.
Rabi, 1908 ...	Pulse ...	Potatoes.
Kharif, 1909 ...	Jute ...	Jute.
Rabi, 1909 ...	Pulse ...	Pulse.

In No. I rotation, none of the crops are manured, while in No. II the potatoes only are manured and they get 150 maunds of cowdung per acre.

Plots 12 to 15 in block A, each $\frac{1}{5}$ acre, were selected for the experiment. The land is high with a sandy loam soil. The experiment is in duplicate, plots 12 and 11 are under No. I rotation and plots 13 and 15 under No. II. Mung was sown as the pulse crop in 1908.

The first crop (jute 1908) grew fairly well, the average yield of fibre per acre from the duplicate plots in No. I rotation being 8 maunds 35 seers and in No. II rotation 8 maunds 30 seers. The rabi crops, potatoes and mung were almost complete failures owing to the drought.

Experiment with jute refuse.—In order to test the effect of a dressing of jute refuse on a rabi crop followed by jute, two plots, Nos 10 and 11, in block A, each $\frac{1}{5}$ acre in area, were taken. Both plots were cropped with maize in the rains of 1908, and after the maize was harvested one plot was dressed with 300 maunds per acre of jute refuse which had been left lying in a heap to rot for 12 months. A crop of peas was taken from both plots in the rabi season to be followed by jute unmanured in 1909.

The results of the pea crop per acre are given below —:

Plot.	Treatment.	Yield.						Total increase over unmanured plot.	
		Grain.		Straw.		Total.			
1	2	3		4		5		6	
		Mds.	srs.	Mds.	srs.	Mds.	srs.	Mds.	srs.
10	No manure ...	8	35	16	29	25	24	.....	
11	300 maunds jute refuse.	13	5	24	37	38	2	12	18

The effect of this treatment on the jute crop remains to be seen, but it would appear from the above results on the pea crop, that jute refuse is likely to prove a valuable manure on light soils of a similar type, which contain very little organic matter.

10. (*a*) Variety.

Wheat Experiments.

(*b*) Manurial.

Variety.—Mozaffarnagar wheat was tried against the local Gangajali variety for the second time. Plots 73 to 82, each $\frac{1}{5}$ acre in block B, were sown alternately with the two varieties, the total area under each variety being one acre.

In 1907-1908 the local wheat did better than the Mozaffarnagar variety. In 1908-1909 the Mozaffarnagar variety was slightly superior in yield to the local variety. All the plots were much damaged by rats, so it is useless to give figures.

I do not consider that the soil of this block is suitable for wheat, so we have decided in future to conduct all experiments with this crop on block D where the soil is heavier and more suited to the crop.

Before the crop was harvested the best 20 plants of each variety were selected and gathered separately. It is proposed to start a small selection experiment next season with these; the seed of each plant will be sown separately in lines as a basis for future selection work.

Manurial.—Green manuring with cowpeas *versus* bare fallowing:—This experiment was commenced in 1906 on $1\frac{1}{5}$ acre plots 63 to 70 in block B. In that year four alternate plots were green manured with cowpeas, and all eight plots were afterwards sown with wheat. The crop suffered from

rust, so no reliable results were obtained. The plots were bare fallowed in the rains of 1907 and again sown with wheat to test the residual effect of the green manure, but the increase in crop due to the green manure was insignificant. In the rains of 1908, the four alternate plots were again green manured with cowpeas, while the other four plots remained fallow, and wheat was sown on all the plots. The crop suffered from drought and the attacks of white ants. The total produce from the unmanured plots was practically equal to that obtained from the green manured plots. We have decided to discontinue the experiment for the present.

Potatoes.

11. It was intended to test the effect of green manuring with Sunn in addition to cowdung, against cowdung alone, but the experiment fell through as the Sunn hemp did not germinate. However, as potatoes are not generally grown in this district, the following results are interesting as showing what might be done with this crop without irrigation. The land was manured with 300 maunds of cowdung per acre about a month before the crop was planted. Planting took place about the end of October and the crop was harvested at the end of February. The seed was the Patna variety obtained from Darjeeling, and the seed rate was $6\frac{1}{4}$ maunds per acre in each case.

The results are given in the following table:—

Plot No.	Area of plot.	Per plot.				Per acre.			
		Yield.	Value of yield.	Cost of cultivation and seed.	Profit.	Yield.	Value of yield.	Cost of cultivation and seed.	Profit.
1	2	3	4	5	6	7	8	9	10
	Acre.	Mds. srs.	Rs. as.	Rs. as.	Rs. as.	Mds.	Rs.	Rs.	Rs.
5	$\frac{1}{8}$	29 7	53 8	25 2	33 8	146	202	126	106
6	$\frac{1}{8}$	34 15	68 12	24 12	44 0	172	344	124	220
7	$\frac{1}{8}$	31 20	63 0	22 8	40 8	157	314	112	202
99 and 100	$\frac{1}{16}$	54 0	108 0	33 8	74 13	180	360	110	250
111A.	$\frac{1}{8}$	25 26	51 8	21 4	30 4	128	256	106	150
Total ...	$1\frac{1}{16}$	174 28	349 9	126 13	222 12	159	318	115	203

The price of the potatoes is taken as Rs. 2 per maund.

The above table shows a profit of Rs. 222-12 on $1\frac{1}{6}$ acres, which works out at Rs. 203 per acre. These results confirm the results obtained in 1907-1908 when a profit of Rs. 152 per acre was obtained from $\frac{5}{6}$ acres. The growing season of the crop was extremely dry, no rain falling from the time of planting to harvesting. In an average season with a few good showers at Xmas, or under irrigation, the crop would probably turn out half as much again. Taking the results of the two years together, there appears to be no doubt whatever but that potatoes would be a very paying crop on soil in this district similar to that of the farm, provided that sufficient manure is applied and the land prepared carefully with the object of conserving the soil moisture.

Malancha (*Malancha capitata*).

12. Malancha has now been grown on the farm for four years. In the year under report we had half an acre under this crop. The land was manured with 135 maunds of cowdung per acre in the middle of March and the seed was sown in the beginning of May at the rate of 14 seers per acre. The crop was harvested at the end of November and, on retting, gave 8 maunds 17 seers of fibre per acre. This is the best result obtained with Malancha so far, the yield in 1906 being 7 maunds and in 1907, $6\frac{1}{2}$ maunds per acre.

Groundnuts.

13. This crop was tried for the first time at Rajshahi. A plot $\frac{1}{5}$ acre in area with a sandy loam soil was chosen and manured with 150 maunds of cowdung per acre at the end of March. The nuts were planted in the middle of May at the rate of $1\frac{1}{2}$ maunds per acre. The crop grew well and gave every promise of success, but, before the nuts were mature, a swarm of rats invaded the field and destroyed practically the whole of the crop. We are trying the crop again this year on about an acre of land, and are taking every precaution against rats. The soil of the farm appears to suit groundnuts, and if we can protect them from disease and animal pests, there is every reason to suppose that they will prove a profitable crop

Non-experimental crops.

14. Detail of the non-experimental crops grown during the year are given in the following statement.

NON-EXPERIMENTAL CROPS.

Crop.	Area. Acres.	Manure per acre.	Actual yield.	Value of yield.	Expenditure.	Profit or loss.	Remarks.
1	2	3	4	5	6	7	8
				Rs.	Rs.	Rs.	
Maize	0·40	*Nil*	173 maunds ...	...	...	...	Fed to cattle.
Jowar	3·55	*Nil*	946 maunds ...	...	...	...	Part fed to cattle green, rest made into stack silo and fed to cattle as silage.
Aus paddy (local Kashia-panja).	1·80	*Nil*	43 maunds grain 62 maunds straw	113	45	68	Grain at Rs. 2-10-0 and straw at Re. 0-1-6
Ditto ditto ...	0·20	100 maunds cowdung.	5 maunds grain 10 maunds straw	14	8	6	Ditto ditto.
Wheat	5·70	*Nil*	65 maunds grain 174 maunds straw	318	115	193	Grain at Rs. 4-8 and straw at Re. 0-1-6 per maund.
Mustard ...	3·20	*Nil*	30 maunds grain ...	150	90	60	Grain at Rs. 5 per maund.
Gram	4·00	*Nil*	108 maunds grain 91 maunds straw	332	111	221	Grain at Rs. 3 and straw and Re. 0-1-6.
Oats	5·03	*Nil*	44 maunds grain 56 maunds straw	137	125	12	Ditto ditto Oats were a failure on about half the area owing to drought.

Distribution of seeds.

15. The following quantities of seed were distributed from the farm during the year :—

Darjeeling Potatoes	... 22	maunds, grown on farm.
Ditto ditto	... 19½	maunds purchased in Darjeeling.
Nainital Potatoes	... 25¼	maunds purchased in Calcutta.
Groundnuts ...	... 10	seers.
Dacca Ganderi Sugarcane	... 5,880	sets.
Jowar ...	... 5½	maunds.
Cowpeas ...	... 10	maunds purchased locally.
Maize ...	... 2	maunds.

Receipts and Expenditure.

The total receipts amounted to Rs. 1,612-14-6 and the total expenditure to Rs. 6,902-1-7 including Rs. 2,172-5-4 for pay and travelling allowance of the establishment.

Inspection.

17. During the year, the Director of Agriculture, the Agricultural Chemist and the Fibre Expert, each inspected the Farm twice, and the Officiating Assistant Director five times. His Honour the Lieutenant-Governor and the Commissioner visited the farm once, and Mr. H. C. Barnes, the Collector of Rajshahi, several times during the year.

APPENDIX.

CROPPING—1909-1910.

Experimental.

1. *Sugarcane.*—The following varieties have been planted on ⅕ acre plots for comparison :—

1. Local Khagri.
2. Samsara (new, from Burdwan).
3. Samsara (farm sets).
4. Dacca Ganderi (farm sets).
5. Vandamukhi (from Rangpur).

There are also smaller plots of Red Mauritius and Paunda. The local system of cultivation has been followed. Unfortunately owing to the long drought in the spring, germination was very uneven, and I do not think we can expect any accurate results this year.

Winter rice.—Our aim has been as far as possible to duplicate the winter rice experiments which are being carried out at Dacca. On plots 31 to 45 in Block A, the Dacca experiment with bonemeal, soluble nitrogenous manures, cotton seed, and fish manure, will be repeated in duplicate. On plots 16 to 22 the Dacca experiment of green manuring *versus* cowdung will be repeated in duplicate, and the planting and spacing experiment on plots 46 to 58 (*vide* Appendix to Dacca Farm Report). A few of the best local coarse and fine varieties will be grown for comparison on plots 59, 60 and 61.

Jute.—All the plots in last year's manurial experiment have been dressed with 5 maunds of castor-cake per acre and sown with jute again, the idea being to test the residual effects of manures applied to the jute crop last year. A crop of winter paddy will be taken after jute.

The rotation experiment and the experiment with jute refuse is being continued.

A fresh experiment with jute refuse has been laid down. The jute refuse was ploughed into the land in the Spring and maize is being taken as the first crop, followed by pulse for the rabi crop to be followed by jute next Spring, without manure.

Wheat.—The Muzaffarnagar variety will be tried against the local Gangajelli wheat on plot 123 B which has been green manured with Dhaincha in the rains. Plant to plant selection will be carried on with both varieties using the seed gathered from selected plants last season.

Oats.—Hissar oats (from seed grown last year at Rangpur) will be tried against the local variety on plot 121 C which has been green manured with Dhaincha. The plot will be divided into four strips of land and the varieties will be sown alternately.

Mustard.—Raipur mustard (from seed grown at Rangpur) will be compared with the local sersu on plots 90, 91, and 92 in block B.

Potatoes.—Small sets *versus* medium sized sets will be tried on plots 75 to 82. The size of the sets is an important factor to be considered when introducing the crop to *ryots*, as the weight of seed per acre depends on the size of the sets; with small sets the weight of seed required per acre is only from 3 to 5 maunds, whereas with medium sized sets the weight of seed required will be from 10 to 15 maunds. At planting time in the plains, seed potatoes go up to Rs. 8 and

sometimes to as high as Rs. 10 per maund in some districts, and the cultivator is naturally reluctant, even if he has the money, to spend up to Rs. 100 per acre for medium sized or large seed. We have found that about 6¼ maunds of seed per acre gives very good results, and our object now is to discover the minimum seed-rate consistent with a fair outturn.

Plots 79 to 82 are reserved for a trial of the Patna variety grown from seed imported fresh from Darjeeling against the same variety from seed grown in the plains.

Groundnuts—Are being grown on an area of about one acre. They have made good growth up to the present.

Mulberry.—Plots 63, 64, 65, 73 and 74, each ⅕ acre, have been planted with mulberry cuttings. Plot 65 is reserved for filling up vacancies in the other plots. The mulberry on the other four plots will be treated similarly until the plots are as even as possible, and then it is proposed to commence a manuring experiment with oil-cake and silt.

Malancha.—About one acre has been put under this crop.

Non-experimental.

2. *Aus paddy.*—About 12 acres, varieties murisboty and Khasi Panja.

Maize (for fodder).—About 2 acres to be followed by gram.

Jowar (for fodder).—About 1·2 acres on last season's experimental sugarcane area to exhaust the land of manurial residues.

Gram.—About 3½ acres after *aus.*

Oats.—About 2 acres, local variety, after green manure.

Sersu.—About 1½ acres, after *aus.*

Potatoes.—After *aus.* About 2·4 acres. Half Nainital and half Patna from Darjeeling. Produce to be sent to the Khasi Hills where they will be planted to produce seed for distribution in the plains next season.

Fallow.—About 1·8 acres, after *aus* is harvested, to be left fallow for next season's sugarcane.

MAP
OF
JORHAT FARM

Scale 21 : 1 M/s

ANNUAL REPORT OF THE JORHAT AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1909.

Introduction.

This station, established in the beginning of the year 1906, is intended principally for the investigation of sugarcane. It is situated about 3 miles south of Jorhat town. Its total area is 35½ acres, of which 1·7 acres is *hola* or ravine land, which has been cropped with winter rice for many years, and the remainder is high land, which was under grass and light scrub jungle before it was acquired.

Soil.

2. The soil of the high land is a reddish sandy loam belonging to the old alluvium. This class of soil is typical of considerable tracts in the Assam Valley and is cropped with sugarcane to some extent.

Four samples of soil and four of sub-soil have been analysed by the Imperial Agricultural Chemist, Pusa. A detailed statement of the analyses was tabulated in last year's report, so it will probably be sufficient to give here an extract of Dr. Leather's remarks—

"There is great uniformity among these soils, and no "appreciable difference exists between any of them. They "are all deficient in lime. The amount of organic matter "as indicated by the organic carbon and nitrogen is higher "than is common to Indian soils. Although there is "abundance of potash, the available portion is very "small and that of available phosphate is also very "small. The mechanical analysis shows the soil to consist "almost entirely of moderately fine sand."

Preparation of the land for experiments.

3. When the land was acquired it was partially covered with jungle and the surface was uneven. The subsequent rooting up of jungle and levelling of the surface caused variability in the fertility of the soil. To remedy this it was proposed to divide the land into plots $\frac{1}{20}$ of an acre each or multiples thereof, and to crop these plots uniformly until they were reduced to an approximately equal state of fertility. This plan was carried out, the plots being separated by paths 2 or 3 feet wide, but since then we have decided to obliterate all plot divisions and to crop the land uniformly as far as possible in large blocks.

Although the actual divisions have been ploughed up we have preserved the sites of the original plots by means of wooden pegs fixed on the boundaries.

Buildings.

4. The farm is equipped with a godown, combined office and rest-house for inspecting officers, quarters for Farm Superintendent and fieldman clerk and a *pucca* cattle-shed. The cattle-shed was completed at the beginning of the year and cost Rs. 2,000.

A small strip of land (about 1·5 acres) adjacent to the Farm has been acquired on which to build huts for coolies.

Rainfall, etc.

5. The rainfall recorded during the growth of the crops referred to is given in the following table side by side with the normal rainfall :—

Month.	Actual rainfall in inches.	Normal rainfall in inches.
1	2	3
1908, April	6·58	8·76
„ May	8·53	9·62
„ June	11·11	11·52
„ July	17·91	15·26
„ August	13·85	14·32
„ September	11·86	9·23
„ October	2·80	4·04
„ November	*Nil.*	0·51
„ December	*Nil.*	0·60
1909, January	0·57	0·93
„ February	0·63	1·41
„ March	0·62	4·28
Total ...	74·46	80·49

The cold weather was unusually dry for Upper Assam, and the shortage of rainfall from October to February told against the crops.

Experiments. 6. These included—

(*i*) Sugarcane—

(*a*) Variety trials with plant and ratoon cane.

(*b*) Manurial experiment.

(*ii*) Winter rice—manurial experiment.

The manurial experiment with sugarcane was designed to test the effect of large and small doses of oilcake, lime, cotton-seed, and fish manure when added to 400 maunds of cowdung. The land had never been tested for uniformity, and it was obvious on observing the surface soil and the growth of the crop that the land must be extremely uneven in character. For this reason the results of the experiment have been omitted altogether from this report.

Ratoon sugarcane.

7. This cane was planted in 1907 on duplicate plots, $\frac{1}{20}$ acre in area, and the results of the first year's cutting appeared in the last report of this farm. The following varieties were ratooned and the results given here are for the first ratoon crop :—

Striped Mauritius	Paunda.
Teli	Mag.
Samara	Kheri.

Majhara.

After the crop of plant cane was cut (March 1908) the field was cleared of all diseased cane and rubbish and the land was hoed. Then 300 maunds of cowdung and 20 maunds of rapecake per acre was applied to the stools in two doses, one in May and another in June. The crop was earthed up on each occasion immediately after the manure had been applied. The crop grew well and in August it was found necessary to tie it up to prevent lodging. The crop was harvested between 27th January to 10th February 1909.

The results are shown in the following statements. Table I gives the analyses of this year's ratoon crop. Table II compares the ratoon crop of the year under report with the previous year's ratoon crop and also with the crop of plant cane of 1907-1908, of which this is the ratoon crop.

TABLE I.

Ratoon cane, 1908-1909, average of duplicate plots taken.

Variety.	Juice.				Remarks.
	Sucrose per cent.	Glucose per cent.	Total sugar per cent.	*Glucose ratio.	
1	2	3	4	5	6
Striped Mauritius	14·39	1·14	15·53	7·9	Borer very bad; lodging slight; red-rot fairly bad.
Toli	10·48	2·39	12·87	22·8	Borer very bad; lodging very bad; red-rot slight.
Samsara	12·02	1·72	13·74	14·3	Borer fairly bad; lodging bad in a few places; red-rot very slight.
Paunda	13·38	1·61	14·99	12·0	Borer bad; *lodging* very little; red-rot very little.
Mag	12·53	1·63	14·16	13·0	Borer slight; lodging very bad; red-rot very little.
Khori	10·84	2·02	12·86	18·6	Borer very bad; lodging slight; red-rot very little.
Majhara	9·39	2·29	11·67	24·2	Borer very bad; lodging very slight; red-rot very little.
Dacca Ganderi	14·99	1·16	16·05	7·7	There was only one row of this variety. Borer was fairly bad, but it heads the list in sugar content and promises well.

*"Glucose ratio"-parts of glucose per 100 parts cane sugar.

The notes in the remarks column were made by Mr. Meggitt, who inspected the crop when it was being harvested. The analyses are also Mr. Meggitt's; a small laboratory has been fitted up on the farm for this purpose.

Compared with the previous year's ratoon cane, these results show in all cases a lower percentage of cane sugar and in most cases a higher percentage of glucose. This makes the glucose ratio higher than it should be for the manufacture of high quality raw sugar. The only exceptions are Striped Mauritius and Dacca Ganderi which gave a juice of fairly high concentration and low glucose ratio. This state of things is probably due to the great prevalence of disease in the plots this year. With the exception of Mag every variety was badly attacked by borers. Lodging was also very prevalent. In view of these facts no definite conclusions can be drawn from the year's results, but the following table comparing the ratoon of 1908-1909 with the previous year's ratoon and last year's plant cane is interesting, as showing the superiority of ratoon yield in the year under report.

TABLE II.

Average of duplicate plots per acre.

Variety.	Ratoon cane, 1907-1908.					Plant cane, 1907-1908.					Ratoon cane, 1908-1909.				
	Yield of cane.	Yield of juice.	Percentage juice on cane.	Total sugar per cent.	Total sugar per acre.	Yield of cane.	Yield of juice.	Percentage juice on cane.	Total sugar per cent.	Total sugar per acre.	Yield of cane.	Yield of juice.	Percentage juice on cane.	Total sugar per cent.	Total sugar per acre.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	lbs.	lbs.			lbs.	lbs.	lbs.			lbs.	lbs.	lbs.			lbs.
Striped Mauritius ...	29,520	18,040	61·1	17·31	3,124	36,941	25,584	69·3	18·52	4,737	55,320	36,690	66·3	15·53	5,696
Teli	31,098	18,572	60·0	17·52	3,253	28,946	18,798	65·0	17·18	3,229	41,360	26,490	64·0	12·87	3,409
Samsara	27,182	19,084	70·2	16·71	3,188	27,039	19,095	70·6	15·13	3,600	40,480	30,380	75·1	13·74	4,177
Paunda	25,913	17,958	69·3	16·48	2,959	27,500	15,589	56·7	18 45	2,872	52,300	33,140	63·4	14·90	4,069
Mag	31,590	23,064	73·8	15·47	3,707	23,022	18,081	61·1	17·26	3,121	54,740	35,170	64·2	14·16	4,981
Khaj	51,064	28,514	55·8	15·32	4,363	36,736	21,853	59·4	16·60	3,627	65,650	37,720	57·5	12·86	4,854
Majhara	33,300	16,982	48·0	13·57	2,297	35,240	20,689	58·7	15·64	3,236	34,960	20,789	59·5	11·67	2,424

It will be noticed that ratoon cane of the year under report is very much superior in respect of total sugar per acre, to both the previous year's ratoon and plant cane, although the percentage of sugar in the juice is very much less. The great increase in yield of cane in ratoon of 1908-1909 over the previous year's ratoon may be partly due to season, but the chief cause of the increase lies in the fact that ratoon canes of 1907-1908 were manured with only 150 maunds cowdung and 10 maunds rapecake per acre, while the ratoon of 1908-1909 received double these amounts.

The three varieties, Teli, Kheri and Majhara, do not appear to have responded to the extra manuring to anything like the same extent as the thicker stemmed varieties. Last year when only half the quantity of manure was applied the thin stemmed varieties compared much more favourably with the thicker stemmed varieties than they do this year when the manuring was more liberal. This is a point which will have to be taken into account when considering which variety of cane is most suitable for cultivators who cannot afford to apply large quantities of manure.

Plant cane.

8. The following varieties were planted on 1-20 acre plots side by side in May 1908 :—

Striped Mauritius.	B. 208.
Paunda.	B. 1753.
Kheri.	B. 376.
Samsara.	Vandamukhi (from Rangpur).
Mag.	Dacca Ganderi.
Teli.	Paunda (from Dibrugarh).
B. 147.	Bogapura.

A dressing of 400 maunds cowdung and 24 maunds rapecake was applied in two doses, half in June and the other half at the end of July.

The system of planting was similar to that followed last year, the sets being first germinated in a nursery and then planted out in rows 3 feet apart with the sets 2 feet apart from centre to centre in the rows.

The difference in the growth of these varieties was extraordinary. The Barbadoes canes did fairly well, but Paunda and Samsara were so poor that they were not worth crushing and were fed to the cattle. The other varieties made only moderate growth. The cause of this state of affairs must be attributed to the extreme unevenness of the soil which was very apparent. Under the circumstances it

is absolutely useless to attempt to compare the yields of these varieties, or even of the varieties which made fairly good growth, as under the enlarged scheme of experiments a large proportion of the crop had to be cut up for sets.

The only figures which can be given are the analyses of the juice of a few varieties of which there was enough cane left over after taking sets to give a fairly reliable result.

The Barbadoes canes will be mentioned in a separate paragraph.

The following table gives the analytical results of five varieties of cane :—

TABLE III.

Variety.	Cane sugar on Juice per cent.	Glucose on Juice per cent.	Total sugar per cent.	Glucose ratio.
1	2	3	4	5
Mag	15·90	0·36	16·26	2·26
Teli	14·55	0·76	15·31	5·20
Vandamukhi	17·51	0·13	17·64	0·75
Bogapura	17·56	0·43	17·99	2·40
Kheri	16·64	0·67	17·31	4·03

Vandamukhi and Bogapura appear for the first time this year and from the point of view of quality of juice have both done extremely well.

The thin hard variety Kheri has also done very well in this respect, and this variety appears to suffer less from drought and the attacks of insects and animals than the other varieties under trial.

Mag is the variety grown by the local cultivators, and this again gave a fairly rich juice and also made good growth under somewhat unfavourable conditions.

Barbadoes cane.

9. These canes were mentioned in the report of 1908-1909 as having arrived from the West Indies in May 1907, when they were planted on small plots. The plant cane of 1907-1908 made good growth, but all the cane was required for planting, so no analyses of the juice could be made. Analyses of the

ratoon crop 1908-1909 and also of this year's plant cane were made and appear in the following table :—

TABLE IV.

Barbadoes Varieties.

Variety.	Ratoon, 1908-1909.					Plant Cane 1908-1909.				
	Per cent. juice on cane.	Per cent. cane sugar on juice.	Per cent. glucose on juice.	Total sugar per cent.	Glucose ratio.	Per cent. juice on cane.	Per cent. cane sugar on juice.	Per cent. glucose on juice.	Total sugar per cent.	Glucose ratio.
1	2	3	4	5	6	7	8	9	10	11
B. 147	79·9	15·65	0·71	16·36	4·6	...	15·17	0·17	15·34	0·93
B. 1753	65·9	15·88	0·71	16·59	4·5	...	15·42	0·16	15·58	1·03
B. 376	56·4	17·20	·43	17·63	2·5	All cane made into sets.				
B. 208	64·7	...	...	...	...	...	19·34	0·15	19·49	0·77

NOTE.—The blanks in the above table were unfortunately caused by misunderstandings on the part of the farm staff.

It should be remembered that the above figures are obtained from the analysis of relatively small quantities of cane, and it will not do to lay too much stress upon them. For the present it is sufficient to say that from personal field observations taken in conjunction with the above figures these varieties would appear to be exceedingly promising.

The juice of all the varieties is rich in cane sugar and very low in glucose. However, nothing definite can be said about the possibilities of these canes until our observations have extended over several years on a larger scale. It may be that the varieties will suffer deterioration owing to the change of soil and climate.

Field observations.

10. In the report of 1907-1908 it was stated that an elaborate system of field observations had been carried out on the whole of the sugar-cane, both plant and ratoon. The system was found to be cumbersome and altogether beyond the capacities of the farm staff. In the year under report the system was somewhat simplified, but if any degree of accuracy is to be obtained the range of the observations will have to be curtailed still further.

This year the following observations were made monthly for each plot, both plant and ratoon:—

1. Number of canes killed by borer.
2. Ditto red-rot.
3. Ditto other causes.

At harvest time the number of canes attacked by borer, red-rot, etc., was noted as also the number of sound canes.

In addition to this, measurements were made of all the canes in 10 average clumps of each variety.

I do not think it wou'd serve any purpose to give the figures obtained from the monthly observations, as the difficulty of recording these accurately is obvious when you consider that the work is done over a fairly large area in the midst of a perfect jungle of cane.

I therefore propose to give only the figures noted at crushing time, as these ought to give a fairly accurate idea of the comparative insect and disease resisting powers of the various varieties.

TABLE V.

Ratoon cane, 1908-1909, $\frac{1}{10}$ *acre duplicate plots.*

Variety.	Number of sound canes.	Canes attacked by		Diseased canes unfit for crushing.	Total.	Per cent.			
		Borer.	Red-rot.			Sound.	Borer.	Red-rot.	Unfit for crushing.
1.	2	3	4	5	6	7	8	9	10
1. Striped Mauritius	705	409	102	25	1,301	54	36	8	2
2. Paunda	303	111	66	27	507	60	22	13	5
3. Majhara	479	1,210	35	28	1,752	27	69	2	2
4. Kheri	2,128	762	36	20	2,946	73	26	1	1
5. Samsara	351	767	32	20	1,170	30	65	3	2
6. Teli	797	626	74	226	1,723	46	36	4	13
7. Mag	771	222	20	64	1,077	71	21	2	6
1. Striped Mauritius	539	709	167	53	1,468	37	48	11	4
2. Paunda	641	685	37	37	1,380	46	48	3	3
3. Majhara	511	906	40	48	1,505	34	60	3	3
4. Kheri	1,330	1,129	53	60	2,572	52	44	2	2
5. Samsara	342	517	40	44	952	36	54	5	5
6. Teli	579	645	19	83	1,326	44	49	1	6
7. Mag	629	218	20	35	902	70	24	2	4

NOTE.—The figures given under borer and red-rot are for canes which were attacked to some extent but which were still fit for crushing.

All the varieties were attacked with borer and red-rot, but borer was much more prevalent than red-rot. At the time of harvesting the ratoons it appears that borer was worst in the Majhara and Samsara varieties and the least affected variety was Mag. Striped Mauritius and Paunda were worst as regards red-rot and Kheri was best

Teli gave the most cane unfit for crushing on account of disease and Kheri the least amount.

Sugarcane—general remarks.

11. As was the case in 1907-1908, arguing from the quality of the juice, the plant cane is superior to the ratoon. The plant cane of all varieties gave a higher percentage of cane sugar and a much lower percentage of glucose than did the ratoon cane. But it often happens that the ratoon crop gives a larger weight of cane per acre, though this is not always the case. Therefore the real test is the yield of sugar per acre, but unfortunately the yield of sugar per acre in the case of the plant cane could not be obtained this year for reasons already explained.

In the year under report the ratoon crop produced a much larger outturn of sugar per acre than the previous year's ratoon crop, in spite of the fact that the percentage of sugar in the juice was less than in the previous year; the reason being that the extra manuring produced a much larger crop of cane.

Amongst the ratoon canes (tables I and II), Majhara again did very badly and has been rejected from future experiments. Striped Mauritius came out best, closely followed by Paunda and Mag. Kheri, although its juice was poor, gave a large outturn of sugar per acre, by virtue of a large crop of cane.

Striped Mauritius gave the second largest crop of cane, but by reason of the quality of its juice it came out top as the largest producer of sugar per acre. With regard to the plant canes (Table III), the two new varieties, Vandamukhi and Bogapura, are promising from the point of view of quality of juice. On the whole the plant cane juices were of a very higher order, high in cane sugar and low in glucose.

The Barbadoes canes give a very high quality juice, but no definite conclusions can be drawn as to their suitability for this district until they have been grown for several more seasons.

Manuring experiment with winter paddy.

12. This was conducted on four $\frac{1}{20}$ acre plots in the east *hola*. The bone-meal was puddled into the land before transplanting the crop and the saltpetre was given as a top dressing when the crop had become established. The results are given below:—

Per acre.

Plot.	Manure.	Outturn of paddy	Average of manured plots.	Average of unmanured plots.	Average increase.
1	2	3	4	5	6
		Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.
1	3 maunds bone-meal, 30 seers saltpetre.	30 15	...	...	...
2	*Nil* ...	20 20	...	...	...
3	3 maunds bone-meal, 30 seers saltpetre.	26 20	...	...	...
4	*Nil* ...	23 25	... 28 17	... 22 2	...

Ground-nuts.

13. This crop was tried for the first time at Jorhat on $\frac{1}{5}$ acre. The land was manured with 150 maunds of cowdung per acre and the nuts were planted at the end of March. The crop grew very luxuriantly, but rats proved troublesome when the nuts were ripening. The crop was harvested in the second week of December, the yield of nuts being 4 maunds 4 seers. This works out at 20½ maunds per acre, but the rats accounted for a considerable quantity. We are trying the crop on a larger scale this year and precautions are being taken against rats. From the appearance of the previous year's crop ground-nuts are likely to be a success on this class of soils in Assam.

Other crops.

14. *Cowpeas.*—The whole of blocks D and E and the portion of block B not under ratoon sugarcane was sown with cowpeas in the spring of 1908 and the crop was ploughed in during the rains for green manure.

Potatoes.—Were planted in the beginning of November on about ·65 acres and manured with 300 maunds of cowdung per acre, but the dry weather told against the crop, which was not irrigated, and the yield was very small, only about 50 maunds per acre.

Linseed—Was sown on about ½ acre manured with 5 maunds of oilcake per acre, but the yield was very small.

Oats and Mustard were sown on the greater part of the area green manured with cowpeas and germinated well, but soon afterwards they died off for no apparent reason, as there appeared to be sufficient soil moisture at the time.

Matikalai, Mung, Masur, Gram and Til sown on small plots in block A also failed.

Rabi crops have thus been a failure on this farm ever since it was acquired in 1906. I do not think it is altogether a question of soil moisture, as there appeared to be a sufficiency at the time the crops were dying off. We have now come to the conclusion that the cause is to be discovered in the fact that the soil is deficient in lime, and available potash and phosphates. The analysis of the soil shows that the total amount of potash and phosphates is considerable, but the available portion very small, and this fact has been considered when arranging next season's cropping scheme (see appendix).

Fruit trees.

15. It was mentioned in the report of 1907-1908 that a considerable number of fruit trees of various kinds had been planted on the farm with the object of ascertaining what fruits could be successfully introduced into Upper Assam. During the year under report the following were added to the collection :—

Plum, "Early Rivers," from Wahjain Tropical Plantation.
Peach, "Nobles" ditto.
" "Early Silver" ditto.
" "Dr. Hogg" ditto.
Pear, "Australian" ditto.
" "Keifer" ditto.
" "Khasia" ditto.
Lime, "Kagchee," from Mr. S. P. Chatterjee, Calcutta.
Sapota ditto.
Loquat ditto.
Litchi, "Muzaffarpur" ditto.
" "Chinese" ditto.
Mango, "Langra," ditto.
" "Respara" ditto.
" "Gopalbhog" ditto.
" "Fazle" ditto.
Plantain (Rampal) from Dacca Farm.

Custard-apple from Botanical Gardens, Saharanpur.

Guava (four varieties) ditto.

Cuttings from our old stock of local, Ceylon, and Kew pine-apples were also planted.

The plums, Chinese litchis, mangoes, plantains, custard-apple and pine-apples have made good growth, but the pears and peaches are not doing well. It is too early yet to predict which fruits are likely to succeed in the long run.

Receipts and Expenditure.

16. The receipts amounted to Rs. 383-7-9 (chiefly by sale of *gur*) and the expenditure to Rs. 10,956-5-8, including Rs. 2,100-14-3 for establishment and Rs. 3,747-7-9 spent under the head of "Capital charges".

Establishment.

17. The establishment consists of a Farm Superintendent on Rs. 100—10—200, and Fieldman Clerk on Rs. 25—1-8—40 and a peon on Rs. 8. There are also two Assamese apprentices working on the farm on Rs. 15 per month.

Inpection.

18. His Honour the Lieutenant-Governor inspected the farm once, the Director of Agriculture once, and the officiating Assistant Director six *times, during the year.* Mr. Meggitt, the Agricultural Chemist, visited the farm on several occasions and spent a considerable time there in connection with the sugarcane experiments.

APPENDIX.

Cropping Scheme, 1909-1910.

1. *Sugarcane.*—Block D.—

The following varieties have been planted on quarter acre plots side by side for comparison :—

1. Samsara (from Burdwan).
2. Ganderi (from Dacca).
3. Paunda (from Dibrugarh).
4. Striped Tana (from Bihar).
5. Mag. (from Pehar).
6. B. 147. Ditto.
7. B. 208. Ditto.

And the following 8 varieties on $\frac{1}{10}$ acre plots:—

1. Striped Mauritius.
2. Teli.
3. B. 1753.
4. B. 376.
5. Bogapura.
6. Vandamukhi.
7. Samsara.
8. Kheri.

In addition there is about $\frac{3}{4}$ acre planted with 21 rows of Kheri and 50 rows of Mag. Selection work is being continued.

All the land for sugarcane was manured with 500 maunds of well-rotted cowdung per acre ploughed in previous to planting the sets.

Last season's plant cane in block A is being ratooned. The ratoon cane in block B has been rooted up and also the plant cane in the manuring experiment in block A.

Cowpeas for green manure have been sown on the whole of block E. About two months before the crop was sown the whole of the land was given a dressing of 30 maunds of slaked lime per acre. The effect of this treatment on the growth of the cowpeas was very marked. The growth was extremely luxuriant and the crop has since been ploughed in for green manure. It is proposed to reserve this block for next year's sugarcane experiments.

3. *Ground-nuts.*—Block C has been put under this crop. Up to the present they are doing well.

4. *Jowar.*—This was sown on the whole of block A, with the exception of the middle portion now under ratoon sugarcane; but soon after germination the crop died off. The land was ploughed up, a light dressing of cowdung was applied and the crop was re-sown, but with similar results. The only land on which *jowar* made any attempt to grow at all was on two plots in last year's sugarcane manuring experiment which had received a light dressing of lime. In view of this fact and also of the fact that cowpeas are doing so well on the limed area, all the land in block A, except that now under sugarcane, will be given a dressing of about 50 maunds of slaked lime per acre. It is proposed to sow *matikalai* for the *rabi* crop. The whole of block B will also be sown with *matikalai.*

5. *Experiment with lime.*—To test the effect of lime on a few other *rabi* crops, a small area to the south of block C will be divided into two equal parts, one part will be limed and the other part will remain untreated. Strips of oats, linseed, and gram will be sown across both the limed and untreated parts.

Since the analysis of the soil shows it to be poor in lime and available potash and phosphates, but yet containing abundance of total potash and phosphates, lime is probably the key to the problem, since it will tend to liberate more potash and phosphates. At any rate it is worth a trial.

Annual Report of the Fruit Experiment Station, Shillong, for the year ending 30th June 1909.

Introductory.

The Fruit Experiment Station and the Upper Shillong Agricultural Station are worked practically as one concern. Some of the fruit trees imported from abroad were for certain reasons, which will be mentioned later on, removed to the Upper Station. I propose, for the sake of convenience, to deal with the cultivation of all the fruit trees in this report.

History and description of the garden.

2. The Fruit Garden commenced work in September 1902. The garden owes its inception to Sir Bampfylde Fuller. It is situated in the village of Umlyngka, 3 miles from Shillong, on the Cherrapunji road, nearly midway between the town and the Upper Shillong Station. Its elevation is about 5,200 feet, *i.e.*, about 200 feet higher than the town. It originally comprised an area of 13·4 acres, which was acquired by purchase from the Khasia owners at a cost of Rs. 406-12-9. An additional area of a little over two acres belonging to the adjoining Government forest has been gradually annexed to the Station, which thus has a total area of about 15½ acres. About two-thirds of this area has been brought under cultivation and planted for the most part with fruit trees and mulberry.

The chief object with which the garden was established was to experiment with various kinds of fruit trees grown in the temperate climates of Europe, with a view to introduce such of them as may succeed into the hill districts which possess a temperate or semi-temperate climate not unlike that of the warmer regions of Europe. The great drawback in the climate of these districts is the early setting in of the monsoon and the consequent excessive humidity of the atmosphere, which interferes with the ripening of fruit. Such fruit as pears, apples, plums, peaches, and apricots are already grown in and about Shillong, but the fruit in almost every case is of an inferior description. It is hoped that by trying a number of varieties of each species, one or more may be found that will ripen early or give good fruit in spite of the rains.

Most of the fruit trees under experiment were obtained from two English firms—Messrs. Bunyard & Co., of Maidstone, and Thomas Rivers & Sons, of Sawbridgeworth, Herts. They arrived in the winter of 1902-1903. Small consignments of plants have since been obtained from time to time from these firms and from Messrs. Kelway & Sons, of Longport, Somerset. Some apples, pears, and Spanish chestnuts were obtained in 1902-1903 from the Saharanpur Botanical Garden. Cuttings of several varieties of grape vines were obtained in 1903 from Kashmir. Several plants also have been propagated from seed. These include cherimoyer, seed of which was obtained in 1903 from the Government Garden in the Southern Shan States, and tree tomato and mountain papaya grown from seed obtained from the Hakgala Garden in Ceylon.

Besides the foregoing, the garden contains small plantations of strawberries, citrons, Khasi oranges, rhubarb, asparagus and a large variety of squash (*Sechium edule*) procured from Madras.

Although most of the fruit trees planted in 1903 grew well, it soon became apparent that the site of the garden, which faces the south and west, was exposed to the high gales which blow from those directions in March, April, and May. It was thought desirable, therefore, to remove some of the trees to a more sheltered place. It was also thought that some of the trees might thrive better at a higher elevation than the Fruit Garden. Some were accordingly transferred to a field in the Agricultural Station of Upper Shillong, which is about 700 feet higher than the Fruit Garden, and having a north east aspect, is well sheltered from the high winds. Other trees were removed to the new field adjoining the Fruit Garden. Some of the trees were removed in September 1903 and some in July 1904.

A stone wall, 7 feet high and 228 feet long, was built in 1906 to protect a certain number of trees from the high winds. Some of these trees were planted with a view to train them on the wall, others at a short distance from the wall, so as to be protected by it from the wind. A row of grape vines has been planted on the windward side of the wall against which they are trained.

Some of the fruit trees are planted on the natural surface of the ground, others on artificial terraces cut out of the hill side.

In 1904, a new line of experiment was initiated at the Fruit Garden, namely, the rearing of the European univoltine silk worm. This experiment has been repeated every year since, and each time with success. A large portion of the garden has been planted with mulberry, chiefly with a view to obtain plants and cuttings for distribution.

An important part of the work carried on at the Fruit Station is the propagation by grafting and budding of such fruit trees as have proved successful, with a view to their distribution to the public. Large numbers of stocks of wild apple, wild pear, peach, plum, wild grape, and Khasi cherry have been planted for this purpose.

Number of fruit trees at the close of the year.

3. Statement I annexed to this report shows the fruit trees which remained alive on the 30th June 1909. Statement II shows the number of stocks planted for grafting purposes existing on the same date.

The following is an abstract of the two statements:—

No.	Species of trees.	Number of trees standing on 30th June.		Number of grafts in nursery on 30th June.		Number of stocks for grafting on 30th June.	
		1908.	1909.	1908.	1909.	1908.	1909.
1	2	3	4	5	6	7	8
1	Apple	49	49	58	51	1081	847
2	Pear	134	213	742	556	2,263	2,117
3	Plum	44	47	88	...	781	930
4	Peach	14	30	216	11	113	126
5	Cherry	37	38	...	1	221	144
6	Apricot	9	14	39	1	...	...
7	Almond	5	5	...	...	...	...
8	Walnut	17	17	2	...	...	...
9	Fig	54	49	1	10(a)	7	7
10	Grape	141	142	205(a)	101(a)	5	

No.	Species of trees.	Number of trees standing on 30th June.		Number of grafts in nursery on 30th June.		Number of stocks for grafting on 30th June.	
		1908.	1909.	1908.	1909.	1908.	1909.
1	2	3	4	5	6	7	8
11	Spanish Chestnut	75	75	145(b)	173( )	...	...
12	Cherimoter	6	6	...	...	...	...
13	Tree Tomato	60	41	03(b)	5(b)	...	...
14	Mountain Papaya	21	20	47( )	7(b)	...	...
15	Loquat	3	3	...	...	...	...
16	Guava	0	5	...	...	...	...
17	Khasi Orange and citron ...	105	105	...	...	...	...
18	Gooseberry	8	9	...	...	...	...
19	Raspberry	11	9	18	4	...	...
20	Currant	18	15	...	...	...	...
21	Nectarine	6	8	22	13	...	...
22	Quince, Common	8	7	...	...	...	...
	Total ...	856	901	1,047	939	4,461	4,194

(a) *Rooted cuttings.*
(b) *Seedlings.*

Weather.

4. The season was unfavourable. Frost set in early in October and the Spring months, March and April were unusually dry. June was exceptionally wet. On account of the dry weather in the Spring the blossom on the trees was very scanty, and the heavy rain in June caused most of the fruit which set to fall off the trees.

Progress of the fruit trees.

5. The majority of the exotic fruit trees on the station have not been very successful up to the present. Generally the conditions at the time of setting fruit are unfavourable, and any fruit which sets usually gets knocked off the trees by heavy rain before it has time to ripen. In the year under report the weather conditions were mo e unfavourable than

usual, with the result that very little fruit came to maturity on the trees. Of the trees now in bearing, apples and pears blossomed and set fruit which however fell off before it matured ; plums, apricot, almond and cherimoyer blossomed but failed to set any fruit ; peaches and cherries have borne fairly well in the past, but in the year with which we are dealing, although they blossomed profusely, very little fruit was obtained. Fig trees and citrons are doing fairly well, as also are the grape vines. Two varieties of English vines bore large bunches of fruit, but the local Shillong variety was not so prolific as usual. Mountain papayas and tree tomatoes are in bearing and are doing well. Gooseberries, raspberries and currants are a complete failure and are rapidly dying out ; they are attacked by a disease which causes the young shoots to die and fall off. No remedy has been found for this disease ; spraying has been tried and the diseased portions are constantly removed, but this treatment has had no effect.

Treatment of the Fruit trees.

6. Most of the trees make a large growth of wood annually. In order to check the growth of wood and to promote the production of fruit, several trees of various species were rootpruned in the preceding year, but this treatment was not particularly successful. In the year under report no rootpruning was done, but most of the apple and pear trees were heavily top-pruned twice—once in the summer and once in the winter. Peach trees and grape vines were pruned once in the winter.

None of the larger trees were manured, but the smaller chestnuts, walnuts, vines and bush fruits received a dressing of well-rotted cowdung, the surface soil being removed from about the base of the trees, mixed with cowdung and replaced.

Fungus diseases and insect pests.

7. The most troublesome fungus disease is that which causes the "die-back" disease of the bush fruits. Up to the present we have discovered no remedy for this. The grape vines used to be troubled by powdery mildew, but since they have been removed to a more open site this disease has almost entirely disappeared.

The leaves of several species of the trees, more especially plums and chestnuts, are attacked annually by swarms of beetles which come in from the surrounding pine forest.

Spraying with Bordeaux mixture is found to check the ravages of the insects without injuring the trees.

Some of the mulberry trees were attacked this year with scale insects, but these were easily checked by washing the trees with Resin mixture.

Strawberries.

8. This crop has so far been very successful. Four varieties are grown—Aprikose, Louise Gantier, Givon's Late Prolific and Alpine. These were all raised from seed obtained from Messrs. Suttons. The total area now under strawberries is about ¼ acre.

The yield was 29¾ seers which was sold at Rs. 1-8-0 per seer and realised Rs. 44-1-0.

Other crops.

9. These include sweet potatoes, groundnuts, rhubarb, asparagus and Jerusalem Artichokes.

Rhubarb and asparagus both do well at Shillong. The year's results are as follows:—

	Rhubarb.	Asparagus.
Area... ...	1,288 sq. yards (¼ acre approximate)	907 sq. yards (⅛ acre approximate).
	Mds. Srs. Ch.	Mds. Srs. Ch.
Yield ...	1 10 4	2 34 4
	Rs. a. p.	Rs. a. p.
Value of yield ...	61 6 0	112 0 0
Cost of cultivation	38 1 6	51 14 11
Profit ...	23 4 6	60 1 1

Jerusalem Artichokes were tried for the first time. A quarter of an acre was planted with tubers, but they failed to germinate. The land was afterwards planted with young seedlings raised from seed in a seed bed. These grew very well and produced about 1½ maunds of tubers which are being saved for planting next season.

Sweet potatoes.

10. The following four varieties were grown for comparison on $\frac{1}{40}$ acre plots:—

1. Virginia.
2. New Jersey.
3. Nonsimmon.
4. Local Red.

The first three are American varieties, and the fourth is a local variety.

The land was manured with 300 maunds of horsedung, 4 maunds superphosphate, 2 maunds sulphate of potash and 1 maund saltpetre per acre.

The crop was grown from cuttings made from tops, planted on the 4th May 1908. Harvesting took place in January 1909. The following table shows the yield of tubers and tops in each case :—

Variety.	Yield per plot.				Yield per acre.			
	Tubers.		Tops.		Tubers.		Tops.	
1	2		3		4		5	
	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.
1. Virginia	4	20	0	5	180	0	5	0
2. New Jersey ...	5	2	0	6	202	0	6	0
3. Nonsimmon ...	4	13	0	5½	173	0	5	20
4. Local Red ...	5	37	3	10	237	0	130	0

For the second time the local variety has beaten the American varieties in the yield of both tubers and tops.

The whole of the crop (tubers and tops) was fed to the cattle on the Upper Shillong Farm.

A small manuring experiment was carried out to see whether there was any advantage in manuring this crop with a complete mixture of artificials in addition to the horse manure. Two $\frac{1}{20}$ acre plots were taken, one was given a dressing of 300 maunds horse manure per acre, and the other received 4 maunds super, 2 maunds potash sulphate and 1 maund saltpetre per acre in addition to 300 maunds horse manure. The results shewed that the additional dressing of artificials only increased the crop very slightly, the increase being only about 5½ maunds of tubers and 8 maunds of tops per acre. This was nothing like enough to pay the cost of the extra manuring.

Groundnuts.

11. This crop was tried for the first time at Shillong on about $\frac{1}{10}$ acre. The land was manured with about 150 maunds of cowdung per acre, and 6¾ seers of seed was planted in the middle of April 1908. The crop was harvested in January and yielded 1 maund 30½ seers (17 maunds 25 seers per acre). This is a low yield, but it will probably increase when the crop becomes acclimatised. The chief drawback to the crop becoming popular in the higher regions of the hills is the ground frosts which occur in the autumn, but on the slopes

of the sheltered valleys there should be no danger from frosts during the growth of the crop.

Sericulture.

12. With the object of introducing the silk-rearing industry into the Khasi Hills, experiments on the rearing of European silk worms have been carried out for the last six years at Shillong. Up till three years ago all our "seed" was imported annually from Europe, but "seed" raised locally has been proved to give as good results as imported seed, so now we only import a small quantity annually to compare with the locally raised seed.

A scheme for training the local Khasis in the silk-rearing industry is being carried out. Selected Khasi youths are being sent to the Rajshahi School for training at Government expense. If they make satisfactory progress at the school—they are each given a grant of Rs. 250 on the completion of their training, to assist them to build a rearing shed and to lay out a mulberry plantation at their home in the hills. When we have sufficient of these trained men scattered throughout the various localities, the industry will probably spread naturally from village to village when the people come to recognise that it is a profitable occupation.

One youth has already returned from the Rajshahi School, and he was placed in charge of the silk-rearing experiments at the farm this season. After the completion of the experiments he returned to his home to make arrangements for starting rearing on his own account.

The experiments in the year under report were carried out with the object of ascertaining how far the variety of mulberry fed to the worms affects the outturn and quality of the cocoons, and also what quantity of leaf is required approximately to produce a given weight of cocoons.

Three lots of seed were used, *viz.*:—

1. Var. (our own seed, 4th generation in Shillong).
2. Var. (Imported from France).
3. Italian yellow (our own seed, 4th generation in Shillong).

The three lots of seed were hatched separately by a man carrying them about under his clothes. This method has been found more convenient than hatching the eggs in an incubator. After hatching each lot of worms was divided into two equal parts. [There are two local kinds of mulberry cultivated at the Farm, one has small leaves and is hereafter

called "small leaf" mulberry, and the other has larger leaves and is locally known as "large leaf" mulberry]. Half of each lot of worms was fed on the "small leaf" and the other half on the "large leaf." The weight of each variety of mulberry fed to the worms was noted, as also was the waste leaf which had to be thrown away. The interval between the time of hatching to commencement of spinning varied from 50 to 55 days in the various lots. This was longer than in the previous year when the period varied from 39 to 45 days. This was probably due to the fact that the temperature of the rearing house was lower during part of the rearing period. The average temperature of the rearing house for the whole period was 63°F. in the mornings and 69°F. in the afternoons.

Seventy-three worms died before spinning from the following causes:—

8 from grasserie disease,

5 from flacherie disease,

3 from court disease,

35 were killed by ants,

and 22 were killed by falling from the trays.

There was no sign of pebrine disease in any of the lots.

Statement A gives particulars of hatching, moulding, and spinning of each tray of worms.

Statement B gives the quantities of leaf fed to each lot and the number and weight of green cocoons obtained from each lot. And statement C gives the average weight and dimensions of the green cocoons and also the weight of shell of silk and the percentage of shell of silk on green cocoons.

When spinning was finished 20 cocoons were picked out at random from each lot for measurement. Then the fifty best cocoons in each lot were selected to produce seed for next year, and the remainder were dried in an oven in the same way as in previous years.

All the moths which hatched out from the selected cocoons were subsequently examined for pebrine, and only one (from imported Var.) was found to be diseased. The moths reared from our own seed were all found to be free from this disease.

The year's results confirm previous year's results as showing that our own seed is quite as satisfactory as imported seed.

From the figures given in statement B, it appears that worms from our own seed thrive better on "small leaf," while the worms from imported seed do better on "large leaf" mulberry.

As regards the quantity of seed required to produce a given quantity of cocoons, the results are not satisfactory, as there has been a great deal too much leaf wasted. The total quantity of leaf fed to all the lots was 21 maunds $19\frac{3}{4}$ seers. Of this 13 maunds $6\frac{1}{2}$ seers was eaten by the worms and 8 maunds $13\frac{1}{4}$ seers was wasted. This works out 41 seers gross and 25 seers net of mulberry leaves required to produce one seer of green cocoons.

STATEMENT A.

Serial No.	Names.	Kind of leaf on which fed.	Date of hatching.	Date of 1st moult.	Date of 2nd moult.	Date of 3rd moult.	Date of 4th moult.	Date of spinning.
1	2	3	4	5	6	7	8	9
1	Var. from our own seed (4th generation in India).	Small leaf ...	19-3-1909	29-5-1909	7-4-1909	18-4-1909	29-4-1909	14-5-1909
2	Ditto ditto ...	Big „ ...	19-3-1909	29-5-1909	7-4-1909	18-4-1909	29-4-1909	14-5-1909
3	Ditto ditto ...	Small „ ...	20-3-1909	30-3-1909	8-4-1909	19-4-1909	30-4-1909	15-5-1909
4	Ditto ditto ...	Big „ ...	20-3-1909	30-3-1909	8-4-1909	19-4-1909	30-4-1909	15-5-1909
5	Ditto ditto ...	Small „ ...	21-3-1909	1-4-1909	10-4-1909	20-4-1909	2-5-1909	16-5-1909
6	Ditto ditto ...	Big „ ...	21-3-1909	1-4-1909	10-4-1909	20-4-1909	2-5-1909	16-5-1909
7	Ditto ditto ...	Small „ ...	22-3-1909	2-4-1909	11-4-1909	21-4-1909	4-5-1909	17-5-1909
8	Ditto ditto ...	Big „ ...	22-3-1909	2-4-1909	11-4-1909	21-4-1909	4-5-1909	17-5-1909
9	Var. imported seed from France.	Small „ ...	19-3-1909	29-3-1909	7-4-1909	18-4-1909	29-9-1909	14-5-1909
10	Ditto ditto ...	Big „ ...	19-3-1909	29-3-1909	7-4-1909	18-4-1909	29-9-1909	14-5-1909
11	Ditto ditto ...	Small „ ...	20-3-1909	30-3-1909	8-4-1909	19-4-1909	30-4-1909	15-5-1909
12	Ditto ditto ...	Big „ ...	20-3-1909	30-3-1909	8-4-1909	19-4-1909	30-4-1909	15-5-1999

STATEMENT A—*concld.*

Serial No.	Names.	Kind of leaf on which fed.	Date of hatching.	Date of 1st moult.	Date of 2nd moult.	Date of 3rd moult.	Date of 4th moult.	Date of spinning.
1	2	3	4	5	6	7	8	9
13	Var. imported seed from France	Small leaf ...	21-3-1909	1-4-1909	10-4-1909	20-4-1909	3-5-1909	16-5-1909
14	Ditto ditto ...	Big „ ...	21-3-1909	1-4-1909	10-4-1909	20-4-1909	3-5-1909	16-5-1909
15	Ditto ditto ...	Small „ ...	22-3-1909	2-4-1909	11-4-1909	21-4-1909	4-5-1909	17-5-1909
16	Ditto ditto ...	Big „ ...	22-3-1909	2-4-1909	11-4-1909	21-4-1909	4-9-1909	17-5-1909
17	Italian yellow (4th generation in India.)	Small „ ...	19-3-1909	29-3-1909	7-4-1909	18-4-1909	29-4-1909	14-5-1909
18	Ditto ditto ...	Big „ ...	19-3-1909	29-3-1909	7-4-1909	18-4-1909	29-4-1909	14-5-1909
19	Ditto ditto ...	Small „ ...	20-3-1909	30-3-1909	6-4-1909	19-4-1909	30-4-1909	15-5-1909
20	Ditto ditto ...	Big „ ...	20-3-1909	30-3-1909	3-4-1909	19-4-1909	30-4-1909	15-5-1909
21	Ditto ditto ...	Small „ ...	21-3-1909	1-4-1909	20-4-1909	20-4-1909	2-5-1909	16-5-1909
22	Ditto ditto ...	Big „ ...	21-3-1909	1-4-1909	20-4-1909	20-4-1909	2-5-1909	16-5-1909
23	Ditto ditto ...	Small „ ...	22-3-1909	2-4-1909	11-4-1909	21-4-1909	4-5-1909	17-5-1909
24	Ditto ditto ...	Big „ ...	22-3-1909	2-4-1909	11-4-1909	21-4-1909	4-5-1909	17-5-1909

N. B.—Four days was the period allowed for spinning.

STATEMENT B.

No.	Names.	Quantity of seed reared.	Kind of leaf fed.	Quantity of leaf fed during the time of rearing.	Quantity of leaf thrown away during the time of rearing.	Quantity of leaf eaten by the silk worms during the time of rearing.	No. of cocoons.	Weight of green cocoons.	Remarks.
1	2	3	4	5	6	7	8	9	10
		Oz.							
1	Var. (from our own seed, 4th generation in India).	$\frac{1}{10}$	Small leaf ...	3 34 8	1 20 8	2 14 0	1,645	0 3 4	
	Ditto ditto ...	...	Big „ ...	3 1 4	1 5 0	1 36 4	1,443	0 2 14	
2	Var. imported seed* (from France.)	$\frac{1}{2}$	Small „ ...	4 17 8	1 27 0	2 30 8	2,615	0 4 12	
	Ditto ditto ...	...	Big „ ...	4 18 12	1 28 4	2 30 8	2,812	0 5 2	
3	Italian yellow (4th generation in India).	$\frac{1}{11}$	Small „	3 5 6	1 10 2	1 35 4	1,432	0 2 12	
	Ditto ditto ...	...	Big „ ...	2 22 6	1 2 6	1 20 0	1,425	0 2 6	
				21 19 12	8 13 4	13 6 8	11,372	0 21 2	

* The total amount of seed set to hatch was 1 oz. but only about half of it hatched out.

STATEMENT C.

No.	Names.	Kind of leaf fed.	Average dimension.		Average weight of green cocoons, grammes.	Average weight of each shell of silk, grammes.	Percentage of shell on weight of green cocoons.
			Length, millimitres.	Width, millimitres.			
1	2	3	4	5	6	7	8
1	Var. from our own seed ...	Small leaf ...	39·370(1·55 in.)	21·894 (·862 in.)	2·283 (·196 tola)	·454 (·039 tola)	19·886
2	Ditto ditto	Big „ ...	36·820 (1·45 in.)	20·32 (·8 in.)	2·178 (·187 tola)	·267 (·023 tola)	13·139
3	Var. imported seed (from France).	Small „ ...	40·64 (1·6 in.)	20·955 (·825 in.)	2·271 (·195 tola)	·349 (·030 tola)	15·367
4	Ditto ditto	Big „ ...	38·860 (1·52 in.)	21·259 (·837 in.)	2·283 (·196 tola)	.454 (·039 tola)	19·88
5	Italian yellow (4th generation in India).	Small „ ...	39·624(1·56 in.)	20·32 (·8 in.)	2·190 (·188 tola)	·361 (·031 tola)	16·48
6	Ditto ditto	Big „ ...	38·10 (1·5 in.)	20·32 (·8 in.)	2·271 (·195 tola)	·361 (·031 tola)	15·896

Distribution of plants and seeds.

13. The following table gives a list of plants and seeds distributed during the year :—

Statement showing number of plants distributed during the year ending 30th June 1909.

No.	Description.	No. or quantity distributed.	No. of persons supplied.		
			Khasis.	Others.	Total.
1	2	3	4	5	6
1	Asparagus plants ...	528	2	8	10
2	Rhubarb „ ...	252	5	11	16
3	„ seed	1 ch.	...	1	1
4	Squash fruits	19	1	7	8
5	Spanish chestnut plants ...	44	1	6	7
6	Pear grafts	118	6	17	23
7	App'e „	37	4	13	17
8	Plum „	10	...	4	4
9	Peach „	134	4	18	22
10	Grape rooted cuttings... ...	66	5	10	15
11	Mulberry „ „	6,790	5	6	11
12	Mountain papaya plants ...	50	3	7	10
13	Strawberry suckers	1,502	3	10	13
14	American sweet potato ...	1½ rs.	1	...	1
15	Khasi „ ...	2srs.	...	1	1
16	Tree tomato plants ...	30	1	6	7
17	Groundnut seed ...	5 srs.	1	1	2
18	Sohiong plants ...	20	...	1	1
	Total		42	127	169

Receipts and expenditure.

14. The total receipts for the year amounted to Rs. 455-2-7 as compared with Rs. 470-11-3 in the previous year. The expenditure was Rs. 3,782-12-0. This does not include salaries of the Superintendent and fieldman clerk which are included in the Upper Shillong Farm expenditure.

A. G. BIRT,

Supernumerary Agriculturist,
Eastern Bengal and Assam.

STATEMENT I.

Showing the number and description of fruit trees at the Fruit Station and the Upper Farm at the close of June 1909.

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Apple ...	Golden Reinette ...	England	September 1903 ...	...	1*	
			July 1904 ...	1*	...	
	Kerry Pippin ...	Ditto ...	Ditto ...	1*	...	
	Cox's Orange Pippin ...	Ditto ...	September 1903 ...	...	1*	
	Ribston Pippin ...	Ditto	Ditto ...	...	1*	
			July 1904 ...	...	1*	
	King of Pippins	Ditto ...	September 1903 ...	...	1*	
		Ditto ...	July 1904 ...	...	1*	
		Locally grafted ...	Ditto 1906 ...	2	...	Planted under the wall.

STATEMENT I.—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Apple ...	Scarlet Golden Pippin ...	England	September 1903 ...	...	1*	
			March 1903 ...	1	...	
	Thomas Rivers ...	Ditto ...	July 1904 ...	...	1*	
	Allington Pippin ...	Ditto ...	Ditto ...	1*	1*	
	Braddik's Nonpareil ...	Ditto ...	Ditto ...	...	1*	
	Manington's Parmain ...	Ditto ...	Ditto ...	1*	1*	
	Devonshire Quarenden ...	Ditto ...	Ditto ...	...	1*	
	Newton Pippin ...	Saharanpur ...	March 1903 ...	3	...	
	Blenheim Orange ...	Ditto ...	Ditto ...	2	...	
		Locally grafted ...	August 1903 ...	1	...	
	Early Harvest ...	Saharanpur ...	March 1903 ...	2	...	
		Locally grafted ...	January 1903 ...	1	...	

Freeman's Apple ...	Old Model Farm ...	About 30 years old...	...	4	Called Freeman's Apple after the name of the Superintendent of the Old Model Farm.
	Locally grafted ...	1898	...	1	
Ditto ditto ...	Locally grafted ...	1901	...	6	
White Apple ...	Ditto ...	February 1906 ...	1	1	
	Ditto ...	March 1906 ...	1	...	
	Ditto ...	„ 1907 ...	3	...	
	Ditto ...	January 1908 ...	2	...	
	Ditto ...	February 1908 ...	2	...	
			...		
		Total ...	25	24	
Besides there were the following number of new grafts not yet planted in permanent stations.					
Early Harvest ...	Budded ...	July 1908 ...	...	11	
Allington Pippins ...	Grafted ...	February 1909 ...	...	2	

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
	2	3	4	5	6	
Apple—*concld.*	Thomas Rivers ...	Budded ...	July 1908 ...	...	1	
	White Apple from Ressenrhode's.	Grafted ...	February 1907 ...	1	...	
		Ditto ...	„ 1909 ...	1	...	
	Unknown ...	Budded ...	September 1908 ...	...	15	
		Grafted ...	February 1909 ...	...	19	
	Scarlet Pippin ...	Ditto ...	Ditto ...	1	...	
			Total ...	3	48	

N.B.—The trees marked with asterisks were transferred from the terraces in the Fruit Garden where they were planted in March 1903.

Pear ...	Souvenir du Congress ...	England ...	September 1903 ...	...			2*
	Beurre D'Ammanlis ...	Ditto ...	March 1903 ...		1	...	
		Ditto ...	September 1903 ...	...			1*
		Locally grafted ...	February 1905 ...	...			1
	Williams Bonchretian ...	Ditto ...	„ 1908 ...		1	...	
	Claps Favourite ...	England ...	Ditto ...	...			2*
	Doyenne du Comice	England	September 1903 ...	...			1
			July 1904 ...		1*	...	
		Locally grafted ...	February 1908 ...		1	...	
	Marie Louise ...	Ditto	Ditto ...		2		1*
			Ditto 1905 ...	...			2
	Ditto	England ...	July 1904 ...		1*	...	
	Ditto	Locally grafted ...	Febraary 1909 ...		2	...	
	Duchess D'Augouleme...	England ...	July 1904 ...		1*		1*
	Conference ...	Ditto ...	Ditto ...		1*		1*
		Locally grafted ...	March 1907 ...		2	...	
		Ditto	February 1909 ...		20	...	

STATEMENT I—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
	...				...	
	Louise Bonne of Jersey...	England ...	July 1904 ...	...	1*	
	Emile D'Heyat ...	Ditto	Ditto	...	1*	
		Locally grafted ...	February 1905 ...	...	3	
		Ditto ...	Ditto 1908 ...	3	...	
		Ditto ...	Ditto 1909 ...	5	...	
	LaConte	Saharanpur ...	March 1903 ...	3	...	
		Locally grafted ...	February 1908 ...	3	...	
		Ditto ...	Ditto 1909 ...	5	...	
	China	Saharanpur ...	March 1903 ...	3	...	
		Locally grafted ...	February 1909 ...	2	...	

N.B.—The trees marked with asterisks were transferred from the terraces in the Fruit Garden where they were planted in March 1903.

	Saharanpur ...	March 1903 ...	3	...	
Kaiffer	Locally grafted ...	February 1905 ...	...	2	
	...	Ditto 1908 ...	2	...	
	Ditto ...	Ditto 1909 ...	17	...	
Kitchon Pear ...	Model Farm ...	30 years old ...	...	2	These have existed since the Old Model Farm.
Unknown Pear ...	Locally grafted ...	1905	2	...	
Rossenrhode's Pear ...	Locally grafted ...	February 1906 ...	4	5	
Ditto ...	Ditto ...	September 1906 ...	9	...	
Ditto ...	Ditto ...	February 1907 ...	30	...	
Ditto ...	Ditto ...	July 1907 ...	1	...	
Ditto ...	Ditto ...	January 1908 ...	5	...	
Ditto ...	Ditto ...	February 1908 ...	28	...	
Ditto ...	Ditto ...	Ditto 1909 ...	29	...	
		Total ...	187	26	

STATEMENT I.—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
	Besides, there were the following grafts not yet planted out :—					
Pear—contd...	Rossenrhode's Pears ...	Locally budded ...	June 1907 ...	...	2	
	Ditto ...	Ditto ...	September 1908 ...	19	...	
	Ditto ...	Locally grafted ...	September 1907 ...	...	21	
	Ditto ...	Ditto ...	January 1908 ...	77	...	
	Ditto ...	Ditto ...	October 1907 ...	45	2	
	Ditto ...	Ditto ...	February 1909 ...	23	129	
	Conference	Locally budded ...	September 1908 ...	6	...	
	Doyenne ducomice ...	Locally grafted ...	January 1907 ...	3	...	
	LaConte	Ditto budded ...	October 1907 ...	1	...	
	Ditto	Ditto ...	June 1908 ...	39	...	
	Kaiffer	Locally grafted ...	October 1907 ...	21	...	

Pear—*concld* ...	Kaiffer	Locally budded ...	June 1903	60	...	
		Ditto ...	September 1903 ...	23	...	
	China	Locally budded ...	Ditto ...	4	...	
	Ditto	Budded ...	July 1903 ...	58	...	
	Unknown	Ditto ...	September 1903 ...	8	...	
	Duchess D'Angoulene ...	Ditto ...	Ditto ...	8	...	
	Beurre D'Anmanlis ...	Ditto ...	Ditto ...	7	...	
			Total ...	402	154	
Plum ...	Mallard	England ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	1	...	
	Czar	Ditto ...	March 1903 ...	1	...	
	Ditto	Ditto ...	September 1903 ...	...	1	
	Ditto	Ditto ...	July 1904 ...	...	1	
	Oullin's Golded Gage ...	Ditto ...	Ditto ...	1	1	
	Jefferson	Ditto ...	Ditto ...	1	1	
	Kirke	Ditto ...	Ditto ...	1	1	
	White Magnum Bonum...	Ditto ...	Ditto ...	...	1	

STATEMENT I. —*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
				...	...	
Plum—*concld.*	Golden Esperon ...	England ...	July 1909 ...	1	1	
	Monarch ...	Ditto ...	Ditto ...	1	1	
	Early Transparent Gage	Ditto ...	September 1903 ...	...	1	
	Swan	Ditto ...	July 1904 ...	1	1	
	Cox's Emperor ...	Ditto ...	Ditto ...	1	1	
	Belgian Purple ...	Ditto ...	September 1903 ...	...	1	
	Ditto	Ditto ...	July 1904 ...	1	...	
	Ditto	Locally grafted ...	January 1903 ...	1	...	
	Early Rivers ...	England ...	March 1903 ...	1	...	
	Ditto ...	Ditto ...	September 1903 ...	...	1	
	Ditto ...	Ditto ...	July 1904 ...	1	...	

Ditto ...	Locally grafted ...	March 1906 ...	1	...	
Ditto ...	Ditto ...	February 1909 ...	3	...	
Belle de Louvain ...	England ...	September 1903 ...	...		1
Ditto ...	Ditto ...	July 1904 ...	1	...	
Blue Rock ...	Ditto ...	September 1903 ...	...		1
Ditto ...	Ditto ...	July 1904 ...	...		1
Sultan ...	Ditto ...	September 1903 ...	...		1
Ditto ...	Ditto ...	July 1904 ..	...		1
Victoria ...	Ditto ...	Ditto ...	...		1
Curlew ...	Ditto ...	Ditto ...	...		1
Greengage ...	Ditto ...	September 1903 ...	...		1
Ditto ...	Ditto ...	July 1904 ...	...		1
Reine Claude ...	Ditto ...	September 1903 ...	...		1
Ditto ...	Ditto ...	July 1904 ...	...		1
Unknown ...	Ditto ...	March 1903 ...	1	...	
Ditto ...	Ditto ...	July 1904 ...	1		1
Denniston Superb ...	Ditto ...	September 1903 ...	...		1
		Total ...	21		26

N.B.—Except those planted in March 1903 and the locally grafted Early Rivers, and Belgian varieties, the rest were transferred to their present stations from the terraces in the Fruit Garden where they were first planted in March 1903.

STATEMENT I.—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Nectarine ...	Cabul	Saharanpur ...	December 1907 ...	6	...	
	Ditto	Locally budded ...	February 1909 ...	2	...	
			Total ...	8	...	
	Besides, there were thirteen grafts waiting to be removed :—					
Peach ...	Early Silver ...	England ...	March 1903 ...	2	...	
	Ditto	Ditto	September 1903 ...	...	1	
	Ditto	Locally grafted ...	1906	1	...	
	Ditto	Ditto ...	February 1909 ...	5	...	
	Noblesse	England ...	March 1903 ...	1	...	
	Ditto	Locally grafted ...	February 1909 ...	2	...	
	Dr. Hogg	England ...	March 1903 ...	2	...	

	Ditto	Locally grafted ...	1906	1	...
	Ditto	Ditto ...	February 1909 ...	7	...
	Rivers Early York ...	England ...	March 1903 ...	1	...
	Ditto	Locally budded ...	1906 ...	1	...
	Ditto	England ...	September 1903 ...	...	1
	Ditto	Locally grafted ...	February 1909 ...	1	...
	Royal George ...	England ...	September 1903 ...	...	1
	China	Saharanpur ...	December 1907 ...	1	...
	Duke of Wellington ...	Ditto ...	Ditto	1	...
	Early Rivers ...	Ditto	Ditto	1	...
			Total ...	27	3

Besides, there were the following grafts locally made waiting to be transplanted :—

Peach ...	Dr. Hogg	Locally grafted ...	July 1907 ...	1	...
	Ditto	Ditto budded ...	June 1908 ...	7	...
	Noblesse	Ditto grafted ...	September 1907 ...	2	...
	Rivers Early York ...	Locally budded ...	June 1908 ...	15	...
			Total ...	25	...

STATEMENT I.—*contd.*

Species of fruit trees.	Varie	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Quince ...	Common	Saharanpur ...	December 1907 ...	2	...	
	Ditto	Ditto ...	January 1908 ...	5	...	
			Total ...	7	...	
Cherry ...	Flemish Red ...	England ...	March 1903 ...	1	1	The trees planted in September 1903 and July 1904 were transferred from the terraces in the Fruit Garden, where they were first planted in March 1903.
	Ditto	Ditto	September 1903 ...	...	...	
	Early Rivers Black ...	Ditto	March 1903 ...	...	1	
	May Duke	Ditto... ...	Ditto... ...	1	...	
	Ditto	Ditto	July 1904 ...	1	...	
	Royal Duke ...	Ditto	March 1903 ...	2	...	
	Ditto	Ditto	July 1904 ...	1	...	
	Ditto	Locally grafted ...	February 1909 ...	1	...	

Giant D'Heidel Finzer...	England ...	March 1903 ...	1	...
Ditto	Ditto	July 1904 ...	2	...
Kent Begarreau ...	Ditto	March 1903 ...	1	...
Ditto	Ditto	July 1904 ...	1	...
Napoleon	Ditto	March 1903 ...	1	...
Ditto	Ditto	July 1904 ...	1	...
Black Eagle ...	Ditto	March 1903 ...	1	...
Ditto	Ditto	July 1904 ...	1	...
St. Margarets ...	Ditto	March 1903 ...	1	...
Ditto	Ditto	July 1904 ...	1	1
Emperor Francis ...	Ditto	Ditto	1	1
Early Elton ...	Ditto	Ditto	1	1
Ditto	Ditto	September 1903 ...	2	1
Cleveland Begarreau ...	Ditto	July 1904 ...	1	...
Guigne D'Winkler ...	Ditto	Ditto	2	...
Governor Wood ...	Ditto	Ditto	1	1

STATEMENT I.—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Cherry—*concld.*	Black Tartarian ...	England ...	September 1903 ...	...	1	
	Ditto	Ditto ...	July 1904 ...	1	1	
	Florence ...	Ditto ...	September 1903 ...	...	1	
	Ditto	Ditto ...	July 1904 ...	...	1	
			Total ...	28	10	

Besides, there was one graft made in February 1909 of Royal Duke cherry waiting to be removed :—

Apricot ...	Royl	England ...	June 1903 ...	1	...	
	Ditto	Locally grafted ...	February 1909 ...	2	...	
	Oullin's Early Peach ...	England ...	June 1903 ...	1	...	
	Ditto	Locally grafted ...	February 1909 ...	3	...	

	Blenheim	England ...	September 1903 ...	...	1	Transferred from Fruit Garden.
	New Large Early ...	Saharanpur ...	December 1907 ...	3	...	
	Cashmere	Ditto ...	Ditto ...	3	...	
			Total ...	13	1	

Besides, there was one graft made in June 1908 of New Large Early waiting to be removed.

Almond ...	Amandier Comunis ...	England ...	February 1904 ...	3	...	
	Ditto	Ditto ...	March 1904 ...	...	1	
	Thin Shell ...	Ditto ...	February 1904 ...	1	...	
			Total ...	4	1	
Walnut ...	Kashmir ...	Kashmir (grown from seed) ...	Summer 1905 ...	12	5	
	Brunswick	Local cuttings ...	July 1905 ...	3	...	
	Ditto	Ditto ...	August 1905 ...	2	...	
Fig ...	Ditto	Ditto ...	September 1906 ...	1	...	
	Ditto	Ditto ...	March 1907 ...	4	...	
	Violette Sepor ...	Ditto ...	June 1906 ...	2	...	

STATEMENT I.—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	
Fig—*concld.* ...	Violette Sepor ...	Local cuttings ...	September 1906 ...	3	...	
	Ditto ...	Ditto ..	March 1907 ...	2	...	
	Bourjasotte Noire ...	Ditto ...	June 1906 ...	2	...	
	Ditto ...	Ditto ...	September 1906 ...	1	...	
	Bourjasotte Grise ...	Ditto ...	Ditto ...	1	...	
	Figue D'or ...	Ditto ...	August 1905 ...	2	...	
	Ditto ...	Ditto ...	June 1903 ...	1	1	
	Ditto ...	Ditto ...	September 1906 ...	1	...	
	Ditto ...	Ditto ...	March 1907 ...	1	...	
	St. John ...	Ditto ...	September 1906 ...	4	...	
	Ditto ...	Ditto ...	March 1907 ...	1	...	
	Black Ischia ...	England ...	November 1903	1	...	

Ditto ...	Local cuttings ...	March 1907 ...	1	...	
White Marseilles ...	Ditto ...	August 1905 ...	1	...	
Ditto ...	Ditto ...	June 1906 ...	1	...	
Ditto ...	Ditto ...	September 1906 ...	2	...	
Ditto ...	Ditto ...	March 1907 ...	1	...	
Colonel De Signora ...	*England* ...	„ 1903 ...	1	...	
Brown Turkey ...	Local cuttings ...	August 1905 ...	3	2	
Poona ...	Poona ...	March 1907 ...	4	...	
		Total ...	46	3	

N.B.—Besides there were the following rooted cuttings waiting to be transplanted :—

Black Ischia ...	Local cutting ...	1907 ...	1	...
Ditto ...	Ditto ...	1909 ...	2	...
Poona ...	Ditto ...	Ditto ...	2	...
St. John ...	Ditto ...	Ditto ...	2	...
Figue D'or ...	Ditto ...	Ditto ...	4	...
White Marseilles ...	Ditto ...	Ditto ...	1	...
Brown Turkey ...	Ditto ...	Ditto ...	1	...
Brunswick ...	Ditto ...	Ditto ...	3	...
		Total ...	16	...

TATEMENT I.—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Frut Station.	Upper Farm.	
1	2	3	4	5	6	
	English, No. 1 ..	Local cutting ...	June 1904 ...	1	1	Nos. 1, 2, 3 and 5, name not known owing to loss of labels.
		England ...	March 1907 ...	1*	...	
	„ No. 2 ...	Ditto ...	January 1908 ...	1*	...	
		Local cutting ...	Ditto ...	1*	...	
	„ No. 3 ...	England ...	July 1903 ...	1*	...	
		Local cutting ...	March 1904 ...	...	2	
	„ No. 4 (Golden Queen).	England ...	January 1908 ...	1*	...	
		Local cutting ...	1904 ...	1	2	
		Ditto ...	1905 ...	1	...	
		Ditto ...	January 1908 ...	2*	...	
	„ No. 5 ...	Ditto ...	Ditto ...	3*	7	
		England ...	March 1907 ...	1*	...	

Grape ...	„ No. 6 (Lady Downe's seedling.	Dit o ...	January 1908 ...	1*	...	
	Local Black ...	Local cutting ... From a vine in the Roman Catholic Mission compound.	1904 ...	4		11
	Ditto	Ditto ...	1905	1	...	
	Ditto	Dit'o ...	1906	1	...	
	Ditto	Ditto ...	February 1907 ...	1*	...	
	Ditto	Ditto ...	January 1908 ...	1*	...	
	Merlot	Cuttings obtained from Kashmir in 1903.	March 1906 ...	3	...	
	Ditto	Ditto ...	February 1907 ...	13	...	
	Cabernet Sauvignon ...	Ditto ...	March 1905 ...	1	...	
	Dit'o	Ditto ...	February 1907 ...	13	...	
	Malbeck wine ...	Ditto ...	March 1906 ...	2	...	
			Total carried over ...	55	23	

* The vines marked with asterisks were removed from the plant-house and from the stable to terraces in the Fruit-Field in March 1907 and January 1908.

STATEMENT I.—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
			Brought forward ...	...	...	
Grape ...	Malbeck wine ...	Cuttings obtained from Kashmir in 1903.	February 1907 ...	5	...	
	Sauvignon Santern ...	Ditto ...	March 1906 ...	2	...	
	Ditto ...	Ditto ...	February 1907 ...	14	...	
	Semiton Sentern ...	Ditto ...	March 1906 ...	3	...	
	Ditto ...	Ditto ...	February 1907 ...	11	...	
	Cabernet	Ditto ...	March 1906 ...	4	...	
	Ditto	Ditto ...	February 1907 ...	12	...	
	Hosseini Cabuli ...	Ditto ...	June 1906 ...	1	...	

	Chassellas	Ditto ...	February 1907 ...	10	...
	Manjuren (wild grape) ...	Local	January 1908 ...	2	...
			Total ...	119	23
	N.B.—Besides there were the following number of rooted cuttings, awaiting removal to permanent sites :—				
Grape ...	English, No. 3 ...	.....	.....	13	...
	Black	.....	.....	26	...
	Kashmir	.....	.....	62	...
			Total ...	101	...
Spanish chestnut.	Spanish chestnut ...	Legacy from former Model Farm about 30 years old.	.....	...	54
	Ditto ...	Saharanpur ...	June 1903 ...	21	...
			Total ...	21	54
	N.B.—Besides, there were 173 seedlings grown locally from seed sown in 1906 and 1908.				
Cherimoyer ...	.....	From seed obtained from the Southern Shan States.	1904	5	...
			1906	1	...
			Total ...	6	...

STATEMENT I.—*contd.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Tree Tomato ...	.....	From seed obtained from Ceylon.	1904	1	...	
			July 1907 ...	40	...	
			Total ...	41	...	
	N.B.—Besides, there were 5 seedlings grown locally from seed.					
Mountain Papaya	.....	From seed obtained from Ceylon.	1904	12	...	
			1906	8	...	
			Total ...	20	...	
	N.B.—Besides, there were 7 seedlings grown locally from seed produced at the Fruit Garden.					

Loquat ...	.....	From cuttings taken from trees in the Station.	1903	3	...
Guava ...	Smooth, green ...	Saharanpur ...	1905	1	...
	Ditto ...	Local layerings ...	1907	2	...
	Cattleya	Saharanpur ...	1905	1	...
	Guineusis	Ditto ...	1905	1	...
			Total ...	5	...
Khasi orange and citron.	.....	Local	1904 & 1905 ...	105	...
	Besides, there was one orange budder on citron waiting to be transplanted.				
Raspberry ...	White Antwerp ...	England, 1906 ...	March 1907 ...	5	...
	Buzyard Superlative ...	Ditto ...	Ditto ...	3	...
			Total ...	8	...

N.B.—Besides, there were 4 plants in the plant house waiting to be removed to the field.

STATEMENT I—*concld.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Gooseberry ...	White Smith ...	England ...	September 1903 ...	...	1	
			July 1904 ...	1	...	
	Crown Bob ...	Ditto ...	September 1903 ...	...	1	
	Lancashire Lad ...	Ditto ...	July 1904 ...	...	1	
	Hedgehog ...	Ditto ...	Ditto ...	...	1	
			Total ...	1	4	

Currant ...	Red Scotch	Ditto ...	September 1903 ...	...	2
	Ditto	Ditto ...	July 1904 ...	2	...
	Boskop Black ...	Ditto ...	September 1903 ...	...	1
	Ditto	Ditto ...	July 1904 ...	...	2
	White Versailles ...	Ditto ...	September 1903 ...	...	1
	Ditto	Ditto ...	July 1904 ...	1	...
	Ditto	Ditto ...	March 1907 ...	3	...
	White Dutch ...	Ditto ...	September 1903 ...	...	1
	Red Utretoh ...	Ditto ...	Ditto	1	...
	Ditto	Ditto ...	July 1904 ..	...	1
			Total ...	7	8

STATEMENT II.

Showing the number and description of fruit stocks at the Farm and Fruit Garden on 30th June 1909.

	At the Fruit Garden.	At the Farm.	Total.
1		3	4
Sohshor (wild pear)	469	1,648	2,117
Sohphoh (wild apple)	24	823	847
Sohiong (Khasi cherry)	144	...	144
Plum	333	617	950
Peach	126	...	126
Fig (wild Khasi)	7	...	7
Manjuren (wild grape)	3	...	3
Sohot (wild chestnut)	5	...	5
Citrons	14	...	14
	1,125	3,088	4,213

Annual Report of the Upper Shillong Agricultural Station for the year ending the 30th June 1909.

Introductory.

Since 1903, this Farm has been managed as a joint concern with the Fruit Experiment Station The main work at the Fruit Station is the cultivation of fruit trees imported from the temperate climates of Europe, but part of this work is carried on at the Upper Station, to which many of the fruit trees were transferred in 1903 and 1904 with a view to test the effects of a higher elevation on their growth.

History and description.

2. The Upper Shillong Station was established in the year 1897-1898. It is situated on the Cherrapunji road, 5½ miles from the town of Shillong, and occupies the site of the old "Model Farm" which ceased to exist in 1879. The elevation of the Station is 5,900 feet, *i.e.*, about 900 feet higher than Shillong town. The boundaries have been surveyed and 8 boundary pillars erected. A more detailed survey of the farm is now in progress. A large area of pine forest was annexed to the Station in 1905. The cultivated area is divided into a number of separate fields having an aggregate area of about twenty-one acres. About ten acres have been added to the cultivated area this year by breaking up new land. All the fields but two lie on the slopes of a long, narrow valley, the bottom of which consists for the most part of marshy land, covered with a thick growth of wild grass. Steps are being taken to drain this valley with the object of making the land suitable for cropping. The forest is of use as a source of timber, a large quantity of which is annually required for fencing and building on the Station.

The soil of the greater part of the Station is a coarse reddish loam of very loose texture, which can be worked with the greatest ease. The sub-soil is of a more pronounced reddish colour and of great depth. In a small portion of the Station the soil is black owing, it is believed, to the existence of some mineral compound. The soils have not been analysed. In point of quality, they are extremely poor, and

very little can be grown on them without the help of manure. The soil at the bottom of the valley is very different from either of the above. It is a dark clay or clayey loam, extremely rich in organic matter. Having been under a thick growth of grass for many years, the upper portion of the soil is a matted mass of half-decayed grass roots.

Besides the natural poverty of the soil, the greater portion of the Station suffers from the disadvantages of an exposed situation. It is colder and more windy than Shillong; frosts are of very common occurrence during the winter, and more severe than in the town. During winter the growth of vegetation is wholly suspended.

The main objects with which the Station was established were the introduction of superior varieties of potato, which is the most important staple grown on the higher plateau of the Khasi Hills, the cultivation of fodder crops and the preservation of fodder in silos for use in the winter when natural fodder becomes extremely scarce, and the encouragement of fruit cultivation. These objects are still kept in view. New items of work have from time to time been added to the programme of the Farm. Among these, the most important is the breeding of improved strains of cattle with a view to their introduction in the district.

Weather.

3. The weather on the whole was unfavourable, specially to potatoes. The autumn crop of potatoes was killed off by exceptionally early frosts in October, before the tubers were mature. Then, in June, the heavy rains spoilt the prospects of the summer crop to some extent.

Work done during the year.

4. This includes—

(1) Potato experiments.
(2) Trials of oats.
(3) Trials of English clovers and grasses and also two Khasia indigenous grasses.
(4) Maize-breeding experiment.
(5) Growing of fodder crops for silage and hay.
(6) Cultivation of fruit trees.
(7) Cattle breeding.
(8) Demonstrations on cultivators' holdings.

D

Potato experiments.

5. These included—

(1) Variety tests.

(2) Manurial trials and spraying with Bordeaux mixture.

(3) Whole *versus* cut sets.

(4) Methods of planting.

(5) Sprouted *versus* non-sprouted sets.

Variety tests.

6. The following seven varieties were grown for comparison on $\frac{1}{20}$ acre duplicate plots :— Magnum Bonum (Farm seed), King Edward VII, Magnum Bonum (from Suttons, in 1908), Nainital (from Nainital in 1908), Khasi Nainital, King of Potatoes and Khasi Round.

Dealt with in report of Fruit Station.

The seed used was the produce of a second crop grown on the farm in the autumn of 1908. The crop was planted during the first week in March and manured with 300 maunds of cowdung and 10 maunds of rape-cake per acre. The seed rate was 10 maunds per acre in each case. The crop was harvested at the beginning of August 1909. The yield of each variety is shown in the following table :—

No.	Variety.	Series I.		Series II.		Average of duplicate plots per acre.
		Total yield per plot.	Yield per acre.	Total yield per plot.	Yield per acre.	
1	2	3	4	5	6	7
		Mds. srs. ch.	Mds. srs. ch.	Mds. srs. ch.	Mds. srs. ch.	Mds. srs.
1	Farm Magnum Bonum.	3 36 0	78 0 0	4 35 0	97 20 0	87 30
2	King Edward VII	4 5 0	82 20 0	4 36 8	98 10 0	90 15
3	Magnum Bonum, Suttons, 1908.	5 28 0	114 0 0	4 31 8	95 3 0	104 35
4	Nainital, 1908 ...	3 21 0	70 20 0	3 29 8	74 30 0	72 25
5	Khasi Nainital ...	4 13 0	86 20 0	6 34 0	137 0 0	111 30
6	King of Potatoes ...	5 20 8	110 10 0	4 2 8	81 10 0	95 30
7	Khasi Round ...	5 18 8	109 10 0	4 33 0	93 0 0	102 25

In the year under review the yields were only about half of what they were in 1907-1908. This must be attributed partly to the check which the autumn crop of 1908 received from frost, and which probably affected to some extent the vitality of the sets which were taken from this crop, and partly to the heavy rainfall at the time the crop was forming tubers.

In 1908-1909 the local variety, Khasi Nainital, has come out top in this series, while King of Potatoes, which obtained first place in 1908-1909, comes fourth.

In addition to the above seven varieties, two varieties, 'Earliest of All' and 'Northern Star' were planted on smaller plots with the object of increasing our stock of seed. There were also three varieties, *viz.*, British Queen, Windsor Castle and Up-to-date, grown for the first time from seed imported direct from Messrs. Suttons.

The yields of these varieties are given in the following table. It will be seen that Up-to-date and Winds or Castle were very much ahead of all other varieties. Both these varieties have been grown in England for many years and have gained an excellent reputation there, but it remains to be seen whether they will be able to withstand the wet weather here during the growing season which is so favourable to disease :—

Serial No.	Variety.	Size of plot.	Yield per plot.		Yield per acre.	
1	2	3	4		5	
			Mds.	srs.	Mds.	srs.
1	Earliest of All	$\frac{1}{160}$	1	36½	43	28
2	Northern Star	$\frac{1}{80}$	1	15	110	0
3	British Queen	$\frac{1}{80}$	2	22	81	24
4	Windsor Castle	$\frac{1}{160}$	8	6½	186	23
5	Up-to-date	$\frac{1}{80}$	12	38	259	0

To get some idea as to the percentage of diseased tubers at harvest time, 10 large, 10 medium sized and 10 sma potatoes of each variety were taken haphazard, cut ope

and examined for signs of disease. The results were as follows:—

Serial No.	Variety.	Large.	Medium.	Small.
		Per cent. Diseased.	Per cent. Diseased.	Per cent. Diseased.
1	2	3	4	5
1	Farm Magnum Bonum	*Nil*	*Nil*	*Nil*
2	King Edward VII	*Nil*	*Nil*	*Nil*
3	Suttons' Magnum Bonum ...	*Nil*	*Nil*	*Nil*
4	Nainital, 1908	10	10	*Nil*
5	Khasi Nainital	10	10	10
6	King of Potatoes	10	10	*Nil*
7	Khasi Round	*Nil*	*Nil*	*Nil*
8	Northern Star	30	10	*Nil*
9	Earliest of All	10	*Nil*	*Nil*
10	British Queen	*Nil*	10	*Nil*
11	Windsor Castle	*Nil*	*Nil*	*Nil*
12	Up-to-date	*Nil*	*Nil*	*Nil*

Northern Star was worst as regards disease and will probably have to be rejected from future trials. The varieties grown from seed fresh from England were free from disease, with the exception of British Queen, which was only slightly attacked.

Manurial and spraying trials.

7. The manuring experiment was designed to test to what extent rape cake can be substituted for cowdung in manuring potatoes. Ten $\frac{1}{20}$ acre plots were taken and all were dressed alike with 150 maunds of cowdung per acre. Then in addition—

Plots 1 and 6 received 20 maunds rape-cake per acre.

Plots 2 and 7 received 10 ditto.

Plots 3 and 8 received nothing.

Plots 4 and 9 received 150 maunds cowdung per acre.

Plots 5 and 10 received 10 maunds rape-cake and 150 maunds cowdung.

Magnum Bonum potatoes were planted on all the plots in the middle of March.

The spraying experiment was carried out on the same set of plots. Half of each plot was sprayed twice with a total of 240 gallons of plain Bordeaux mixture per acre. The results are given in the following table :—

Serial No.	Manuring cowdung, 150 maunds.	Series I.				Series II.				Average per acre.		
		Sprayed.		Unsprayed.		Sprayed.		Unsprayed.		Sprayed.	Unsprayed.	Total.
		Per plot.	Per acre.	Per plot.	Per acre.	Per plot.	Per acre.	Per plot.	Per acre.			
1	2	3	4	5	6	7	8	9	10	11	12	13
		Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.
1	Plus 20 maunds rape-cake	2 25½	105 30	1 37½	77 20	2 13½	93 10	1 38	78 0	99 20	77 30	88 25
2	Plus 10 maunds rape-cake	1 31½	79 20	1 27½	67 20	1 32½	72 20	1 20½	60 20	76 0	64 0	70 0
3	Plus nil	1 15½	55 10	0 38	33 0	1 4	44 0	0 38½	38 20	49 25	38 10	43 37
4	Plus 150 maunds cowdung	1 18½	58 20	1 8	48 0	1 26½	66 20	1 6½	46 10	62 20	47 5	54 32
5	Ten maunds rape-cake, 150 maunds cowdung.	2 4½	84 10	1 28½	68 10	2 16½	96 30	1 38½	78 20	90 20	73 15	81 37
						Average per acre sprayed				75 25	...	...
						Average per acre not sprayed ...				...	60 4	...
						Increased yield due to spraying per acre				15 21	...	...

As the yields on all the plots in the year under report are so small, it is not possible to draw any definite conclusions from this experiment. It is very difficult to put a money-value on cowdung, but it would appear from the above figures that when the supply of cowdung is short, a dressing of 10 maunds per acre of oil-cake added to 150 maunds of cowdung would be more profitable than 20 maunds of oil-cake added to cowdung. Oil-cake in Shillong is very dear on account of the freight, the current price being about Rs. 3-8 per maund delivered at Shillong, and in a case like this where the yields are so small, the cost of the oil-cake is not covered by the extra yield. If sufficient cowdung is available at planting time, it would probably be more profitable to apply from 300 to 400 maunds cowdung per acre alone, but when large quantities of cowdung are not available, a small dressing of oil-cake added to about 150 maunds of cowdung is likely to be profitable. The experiment will have to be carried over several more seasons before any profit and loss account can be worked out. It has been proved beyond doubt by several consecutive years' experiments, that spraying with Bordeaux mixture against disease pays heavily, and demonstrations are being made on cultivators' holdings with the object of inducing them to take it up.

In the year under report the average increased yield due to spraying is only 15½ maunds per acre, which at Rs. 2 per maund = Rs. 31. The cost of spraying (including materials, etc)., was about Rs. 17 per acre, so the profit works out at only Rs. 14 per acre. This is a poor result when compared with the previous year's result, when the profit from spraying worked out at from Rs. 80 per acre and upwards, but it must be remembered that in the year under report the yields in nearly every case were less than half of what they were in the previous year, on account of the favourable season.

Whole *versus* cut sets.

8. In 1907-1908 the yield obtained from cut sets was practically equal to that obtained from whole sets. In 1908-09 the experiment was repeated on $\frac{1}{20}$ acre duplicate plots, and the results obtained in the previous year were confirmed. The cut sets were large tubers cut into two parts; the whole sets were medium-sized tubers. King of Potatoes was the variety used in this experiment. The plots were all manured with 300 maunds cowdung and 10 maunds oil-cake per acre. The number and weight of sets was the same for all the plots.

The crop was planted in the middle of March and harvested at the beginning of August. The results were as follows :—

No.	——	Series I.		Series II.		
		Yield per plot.	Yield per acre.	Yield per plot.	Yield per acre.	Average per acre.
1	2	3	4	5	6	7
		Mds. Srs.	Mds. Srs.	Mds. Srs.	Mds. Srs.	Mds.
1	Cut sets ...	7 2	141 0	8 12	166 0	153½
2	Whole sets	7 12	146 0	8 1	160 20	153½

From the results of the last two years it appears that when short of sets, large tubers may be cut to form two or more sets without any danger of diminution in the crop.

Methods of planting.

9. The local method of planting potatoes is in beds. The tubers are planted in holes 1½ feet apart in the beds and each plant is earthed separately. This method was compared with the ordinary method of planting the sets in drills on top of the manure, and earthing the plants in rows. The experiment was carried out in duplicate on four $\frac{1}{10}$ acre plots. King of Potatoes was the variety used. All the plots were manured with 300 maunds cowdung and 10 maunds rape-cake per acre. The sets were planted on the 20th March and the crop was harvested on the 11th August.

The yield of tubers was as follows :—

No.	Method of planting.	Series I.		Series II.		
		Per plot.	Per acre.	Per plot.	Per acre.	Average per acre.
1	2	3	4	5	6	7
		Mds. Srs.	Mds. Srs.	Mds. Srs.	Mds. Srs.	Mds.
1	Local ...	5 39	119 20	5 37	118 20	119
2	Ordinary...	6 18	129 0	5 38	119 0	124

The results are slightly in favour of the ordinary method.

10. This experiment was carried out on duplicate plots, each $\frac{1}{20}$ acre in area. One lot of sets was sprouted in boxes before planting. The results are not worth recording as the sprouted sets gave a lower yield than the non-sprouted sets in each case, the only inference is that the sprouts got knocked off or injured when the tubers were being planted.

Sprouted *versus* non-sprouted sets.

11. In order to see whether oats can be grown successfully on the higher parts of the Khasi Hills, two attempts were made at the Farm last season. The first attempt was made in the middle of October 1908, when about $1\frac{1}{4}$ acres were put under this crop. The seed germinated well, but night frosts followed by the hot sun in the day time killed off the plants. In the spring of 1909 about $\frac{1}{2}$ acre of land was manured with 150 maunds of cowdung per acre and sown with oats in the middle of April. The seed did not germinate very well, but what did germinate grew fairly well and ripened in August. The yield was only 6 maunds of grain per acre. The straw was from $1\frac{1}{2}$ to $2\frac{1}{2}$ feet in length. It is proposed to try the crop again this autumn, sowing rather earlier, so that the plants may get well established before frost sets in.

Oats.

12. An attempt was made to introduce some of the more common English clovers and grasses. For this purpose small packets of each of the following clovers and grasses were obtained from Messrs. Suttons:—Red Clovers, Perennial Red Clover, Alsike, Lucerne, Lupin, Suttons' Mammoth, White Clover, tmall White (or Dutch) Clover, Perennial Rye-grass and Italian Rye-grass. The seed of each was divided into two equal parts. Half was sown on small beds in the beginning of November and the other half in March. The seeds germinated well on both occasions, but the clovers have all died out. The Rye-grasses remain, but are rather stunted in growth, and I am afraid they would not be able to hold their own against indigenous grasses and weeds if left to themselves.

Clovers and grasses.

Two of the best local wild grasses have been planted on $\frac{1}{4}$ acre plots from rootlets collected from the jungle. One of these, Langtyl-li, promises very well and it is proposed to cut it next year for hay if it has made sufficient growth.

Nam d U Proot and U Langty li.

Maize breeding.

13. An experiment was commenced in 1908 with the object of improving the local maize. Forty-eight of the finest cops of yellow maize were collected from 48 different Khasi cultivators (one cob from each cultivator). The best 60 grains in each cob to a line. As soon as "tassels" appeared, each plant in every alternate line was "detassled," as also were any sickly plants in the other rows. When the crop was ripe each "detassled" row was harvested separately and the best cob in each row was selected for sowing next year. Thus the stock of seed was all cross-fertilized. In selecting the cobs for seed, attention was paid to the colour and size of the grain, number of grains on cob, absence of blanks on cob, regularity of grains on the cob, etc. The experiment is being continued this year with seeds from the selected cobs, the object being to work up to a fixed type, by rejecting all cobs for seed which do not conform to the type in view.

Fodder crops for silage and hay.

14. As growth is practically suspended during the cold weather, silage has to be made to feed the cattle. For this purpose maize and "Job's tears" were grown in 1907-08 and this was augmented by grass collected from the jungle. The total amount of green stuff put into the silos was 1,122 maunds, of which 795 maunds (about 71%) was recovered as good silage and fed to the cattle during the winter. Of the remainder, 232 maunds (about 21%) was unfit for use and 95 maunds (about 8%) represents loss in the silo due to fermentation and drying. These results are the most satisfactory obtained so far; in 1907-08 we got 60% good silage and the year before only 40%.

This year the following fodder crops are being grown:—

Maize	...	...	1·75 acres.
Raishan	...	...	7·25 „
Job's tears	...	...	1·75 „
Raitruh	...	...	1·50 „
Rymbaija	...	...	0·75 „
	Total		13·00 „

The maize and Job's tears will be put into silos. It is proposed to make hay of the raishan and raitruh, as these are very thin-stemmed varieties similar to grasses.

Cattle breeding.

15. A herd of Patna cattle is kept with the object of breeding bulls for distribution amongst the hill cultivators in order to improve the local breed of cattle. Experiments have been made for several years in crossing both Khasi and Bhutia cows with Patna bulls, and the result has been in each case an improved type of animal both as regards milking capacity and general appearance. We are now gradually increasing the herd of Patnas and getting rid of the cross-bred stock. Our object in future will be to keep a pure-bred herd of Patnas to provide young bulls for the hill district. The bulls will be sent out when they are three years old. We have found that the local cultivators are very keen on getting our young bulls at any age, but we have decided to keep them until they are three years old in order to prevent them from having their growth checked by being put to service too young.

In December last, two new bulls and one cow were introduced, and the old bull was removed to the Fruit Station, where he will serve cows brought in by cultivators. More cows will be bought as funds become available. Since the close of the year, a number of cross-bred animals have been disposed of.

The following table shows the cattle on the Farm at the close of the year :—

	Patna.	Bhutia.	Patna and Bhutia.	Patna and Patna-Bhutia cross.	Khasi.	Patna and Khasi.	Patna and Patna-Khasi cross.	Total.
1	2	3	4	5	6	7	8	9
Bulls	2	...	...	...	...	...	...	2
Cows	10	2	2	...	6	5	...	25
Young bulls	7	...	...	...	...	9	1	17
Heifers	10	...	1	1	...	14	...	26
Bull calves	5	...	1	...	...	5	3	14
Heifer calves	2	...	2	1	...	2	1	8
Total	36	2	6	2	6	35	5	92

NOTE.—Besides these there are two Hindustani and four Khasi plough-bullocks.

The total cost of maintaining the herd during the year under report was Rs. 3,023-4-11.

Details were as follows :—

	Mds.	Srs.	Ch.	Rs.	As.	p.
Oil-cake ...	336	22	8	1,321	13	10
Matikalai ...	187	4	4	1,095	13	1
Salt	14	21	12	56	5	0
Grass	2,142	16	0	403	0	8
Rice	24	24	2	146	4	4
Value of Farm produce,						
Silage	795	0	0	415	13	0
Sweet potatoes ...	134	27	0	134	10	9
Mangels	5	20	0	8	4	0
Potatoes ...	16	20½	0	24	12	3
Wages of cowman ...		...		395	3	6
Total Rs.				978	11	6

The total outturn of milk during the year under report was 111 mds., 21 srs., 6 ch., sold for Rs. 557-7-0.

Sheep.

16. With the object of improving the local breed of sheep, a small sheep breeding experiment was commenced last February. A Dhumba ram was procured and let run with five local ewes. Three of the ewes were in lamb when purchased and have each since dropped a lamb. All the ewes have now been covered by the Dhumba ram and two half-breed Dhumba ram lambs have been dropped. These are very superior to the local sheep, which are miserable animals. It is proposed to gradually increase the flock, and if the experiment proves successful, we shall attempt to introduce the Dhumba blood amongst the local people.

Receipts and expenditure.

17. The total receipts for the year 1908-09 amounted to Rs. 1,077-10-7 and the expenditure to Rs. 10,514-3-3, including Rs. 2,061-8-8 for establishment and Rs. 1,0 5-10-2 for capital charges.

Demonstration.

18. In 1908-09 demonstrations on the spraying of potatoes with Bordeaux mixture and the manuring of winter paddy with bone-meal and saltpetre were carried out on an extensive scale on cultivators' holdings in the Khasi Hills. Two Khasis who had been trained for two years at the Farm were

sent out to make the demonstrations. One had his headquarters at Mowphlang and the other at Mairang. The Farm Superintendent exercised a general supervision over the work.

The results of the spraying demonstrations were very satisfactory. The paddy results will not be available until December.

The demonstrations were carried out on such an extensive scale that they cannot be dealt with in this report, so it is proposed to issue a separate report on them when all the detail are obtained.

ANNUAL REPORT ON THE TROPICAL PLANTATION AT WAHJAIN FOR THE YEAR ENDING THE 30TH JUNE 1909.

History and description.

The tropical plantation was started in January 1904. It is situated on the southern slopes of the Khasi Hills, the home of the Sylhet orange, and occupies the top and slopes of a ridge about 1,200 feet above the sea level. The site of the plantation was selected by Rai B. C. Basu, Bahadur. It is close to the Cherrapunji-Theria bridle-path and about seven miles below Cherrapunji.

The plantation was opened under the orders of Sir Bampfylde Fuller with the idea of experimentally introducing certain of the tropical products of Ceylon and Madras, the most important among these being cocoa, the greater and the lesser cardamom, cinnamon, nutmeg, clove, camphor, and lemon-grass. Mr. Basu was deputed by Government in the Autumn of 1903 to Madras and Ceylon to study the cultivation of these products and to procure seeds and plants. Various tropical fruit-trees, new to the Khasi Hills, were procured for trial, most of them being obtained from the Royal Botanical Garden at Peradeniya in Ceylon and from Madras. The plantation also contains a small area planted with coffee, which has been in recent years introduced by private enterprise into the Khasi Hills, and a large number of the more common economic plants of the country, such as oranges, different species of citrus, of betel-nut, pan and black-pepper. These are being cultivated for observation and study.

The plantation has an area of 53·54 acres. The whole area was under forest at the time of acquisition. The first operation undertaken was to mark out a number of fields and to remove the forest by felling and burning. In two fields the forest has not been wholly removed; the larger trees having been retained for shade and the ground underneath cleared of undergrowth. These two fields are intended for the rearing of such plants as cardamoms, which are unable to stand full exposure to the sun. Up to the close of the year under report 14·50 acres have been planted. This area is divided into six fields, the lowest of which is 600 feet below the top of the ridge.

2. The surface of the land is strewn with boulders, which give it an uninviting appearance. The boulders prevent the soil which lies among them from being washed away by the heavy rain which falls on the southern slopes of these hills. The rocky nature of the ground does not permit of plough or spade cultivation.

Soil.

The rocks on the surface are mostly sandstone, but out crops of limestone are seen at several places. The soil in the greater portion of the plantation is a loose loam, dark on the surface owing to admixture of organic matter, but of a yellowish colour underneath. The soil is mixed with gravel. In places the soil is very sandy, and trees planted in it do not thrive well. Among the limestone rocks the soil is of an adhesive texture, very different in quality from the soil found on the greater portion of the plantation.

Two samples of soil from the plantation were analysed by Dr. Leather, with the following results :—

—	No. 1.	No. 2.
1	2	3
Per 100 *parts of whole soil.*		
Stones	3·62	17·48
Fine earth	96·38	82·52
	100·00	100·00
Per 100 *parts of fine earth.*		
Insoluble silicates and sand ...	72·63	78·43
Ferric oxide	5·43	2·86
Alumina	10·85	11·20
Manganous oxide	0·09	0·03
Lime	1·06	0·15
Magnesia	0·58	0·41
Potash	1·74	1·97
Soda	0·10	...
Phosphhoric acid	0·05	0·03
Sulphuric acid	0·06	0·01
Carbonic acid	0·07	0·05
Organic matter and combined water	7·31	4·87
	100·00	100·00

—	No. 1.	No. 2.
1	2	3
Nitrogen	0·15	0·05
Available P_2O_5	0·0015	0·0004
„ K_2O	0·009	0 008

Dr. Leather reported as follows on the two samples :—

"No. 1 contains a fair amount of organic matter and nitrogen and a large amount of potash (total), but the amounts of carbonate of lime and readily available phosphates and potash are decidedly small. No. 2 is a quite different soil. It is white and contains comparatively little iron, with a high proportion of alumina. Of the chief plant foods it contains only very little, and should respond well to any complete manure."

Sample No. 1 was taken from a spot containing limestone rock, and No. 2 from a spot a few feet away which rested on sandstone. Sample No. 2 represents the main class of soil found on the plantation.

Climate.

3. Wahjain lies a short distance below the plateau of Cherrapunji, which holds the world's record for rainfall, and which it resembles in respect of the heavy precipitation that occurs during the Spring and Summer months. During the Spring and early Summer (March to May), the weather is characterised by high winds and frequent thunderstorms, with heavy bursts of rain, which bring on a quick growth of vegetation. The monsoon follows with rainfall not much less than that of Cherrapunji itself, and is succeeded about the middle or end of October by calm and almost rainless weather, which continues through the winter till about the middle of March.

There is far too much rain during eight months of the year and practically none for a continuous period of four months. Herein the climate of Wahjain differs from that of Ceylon and other tropical countries where such long periods of drought are unknown. The absence of rain has been found

particularly trying to such essentially-tropical plants as the nutmeg and clove, the latter of which has died out. It is also very possible that the winter temperatures of Wahjain are too low to suit such plants. The lowest recorded temperature in the shade was 43° F. in February 1905 and the highest 90°F. in May 1908.

Character of the season.

4. The rainfall on the plantation from July 1908 to June 1909 was as follows:—

Month.	Rainfall.	Number of rainy days.
1	2	3
	Inches.	
1908, July	58·54	28
„ August	31·40	26
„ September	50·57	16
„ October	5·27	4
„ November	*nil*	0
„ December	*nil*	0
1909, January	0·28	1
„ February	0 45	1
„ March	*nil*	0
„ April	10·74	15
„ May	36·90	28
„ June	75·19	24
Total for the year ...	269·84	138

Rainfall has been recorded at Wahjain since Septembe 1904. The normal rainfall of the place cannot be state until the record has extended over a longer period. Bot this season and last, the long drought from October to Marc was very trying to most of the plants.

Work done during the year.

5. On account of the extremely rocky character of the ground the method of cultivation is very simple and consists only of loosening the soil around the plants and keeping down jungle growth.

The only manures used during the past year have been mustard oil-cake, and cowdung.

Some trees received cowdung alone, and others received both cowdung and oil-cake. The rate at which cowdung was applied varied from one-third to one basket and that of oil-cake from one to four chittaks to each plant, the quantity varying according to the size and age of the tree.

The scheme of manuring drawn up by Mr. Basu in 1908, the details of which were shown in last year's report, has not been continued during the year under review.

In February, the soil at the base of the cocoa plants was "mulched" with the refuse from the distillation of lemon-grass oil, as was done in the previous year. In future this will be done at the commencement of the cold weather. It is hoped in this way to conserve the soil moisture, which rapidly dries up in the cold weather on this rocky land.

The distillation of lemon-grass oil has continued during the year under review, but the quantity produced falls considerably short of that for the previous year. During the year four cuttings and distillations have been made. The first (Tyrna grass) started on September 8th, 1908, and lasted till October 30th; the second (Moriani grass) lasted from November 16th till November 30th; the third (Ceylon grass) lasted from December 1st to December 11th; and the fourth (Tyrna grass) lasted from May 22nd to June 25th.

The following table shows the amount of grass cut and the quantity of oil obtained in fluid ounces :—

—	Amount of grass.	Oil fluid ozs.	Oil fluid ozs. per maund grass.
1	2	3	4
	Mds.		
First distillation—(Tyrna)	99	341½	3·42
Second distillation—(Moriani)	15¾	67½	4·38
Third distillation—(Ceylon)	12	55¾	4·64
Fourth distillation—(Tyrna)	13¾	4	3·32
Total ...	140½	510½	...

The total amount of oil produced during the year was thus 510½ fluid ounces. Details of the cost of production have not been kept this year, but in the previous year these were carefully estimated and found to work out at Re. 1-6-7 per 12 ozs., or Re. 0-1-10 per oz., and the total cost of production this year has not exceeded that amount. In the year 1907-1908, 526 ozs. of oil were sold to a soap manufacturer at annas 4 per oz. and in February 1909 a further quantity of 224 ozs. was sold to a Calcutta firm at annas 5 per oz. Thus it is seen that a profit of 2-3 annas per oz. can easily be obtained.

In May of the present year an arrangement was made with a Khasi to cut the grass and distil the oil for us at a rate of Re. 1-8-0 per 12 ozs., chiefly with a view to disseminate a knowledge of the cultivation and distillation of the oil among the Khasis. About forty Khasis have already started cultivating the grass which was procured by them from the plantation.

At the end of the past year, June 30th, 1909, 595 ozs. of oil were still in stock and an effort will be made to dispose of this at an early date.

Plants under trial.

6. The annexed list shows the various species of plants under trial, the sources from which they were obtained, their age and the progress which each species has made. In the case of the plants which have begun to yield, the results obtained have been noted in the remarks column.

The most important plants for the sake of which the Tropical Plantation was created are cocoa, coffee, lesser cardamom, cinnamon, nutmeg, clove, citronella and camphor. Citronella, however, did not reach the plantation alive and the lemon-grass is being cultivated in its place. Cloves also have since died out, the climate being evidently unsuitable.

Camphor.

7. The camphor trees are making good growth, and are now about 7 feet high. It is proposed to try the method of distilling camphor from twigs on the system which has been experimentally introduced in Ceylon.

Coffee.

8. The coffee trees are thriving well and were topped and pruned in December. It is proposed to keep them down to a height of 5 feet by nipping off the leading shoot. A crop of 10 seers was

obtained in November 1908, half seer of which was sent to the Shillong Flower Show in May of the present year.

Cinnamon.

9. The cinnamon trees are very healthy and have a good growth of wood, the tallest having now attained a height of about 8 feet.

Lemon-grass.

10. The total area under lemon-grass remains the same, 3·51 acres. As shown in the annexed list the grass was obtained from four different places, *viz.*, Ceylon, Tyrna (Khási Hills), Moriani (Assam), and Cochin (Madras). Only the grass from Cochin has flowered, and it has been identified by Captain Gage, Superintendent, Royal Botanic Gardens, Sibpur, as *Andropogon nardus, L.*

The clumps of lemon-grass were originally planted in rows 3 feet apart, with an interval of 3 feet between the clumps in the row, but during the year 1907-08, on about half the area, additional rows were planted, making an interval of only 1½ feet between the rows.

Nutmeg.

11. Nutmeg is growing very slowly. Two plants have died during the year of drought. The climate seems to be too dry for it in the cold weather.

12. Of the plants subsequently introduced into the scheme of the plantation, pineapples, Natal oranges, sapota, litchi and mango trees are doing well. Since May of the present year some 50 to 60 pineapples have been obtained. Some of these have been distributed to Khásis and others sent to Shillong for sale.

Fungus disease of cardamoms.

13. *Plant diseases.*—The only serious disease noticed in the plantation is the cardamom disease.

Cardamom.—The root fungus referred to in last year's report continues to attack the cardamom plants. Nine clumps have died during the past year, leaving only 2 clumps out of the 169 which were planted in July 1906. Of the 100 new clumps obtained from the neighbourhood of Shillong and planted in June 1908, 74 died of the long drought which prevailed from November to March, but the remainder have as yet shown no sign of the root-fungus disease. The treatment recommended by Dr. Butler, Imperial Mycologist, of pulling up and burning diseased plants and applying

lime to the holes has been gone on with, but the disease continues to spread.

Orange blight.

14. The orange blight which is so prevalent in the Khasi Hills, and which is being investigated by Dr. Butler, has not yet appeared on the plantation.

The experiments (detailed in last year's report) which were started in June 1908, with a view to finding some means of checking the disease, are still being continued, but it is too early yet for any definite results. It is hoped that a full account of the progress made will be given in next year's report.

Budding oranges.—During the past year budding of oranges on various citrus stocks has been started at the plantation, with the hope that some of these stocks may be found immune to the orange disease. In this connection an expert budder was brought from Nagpur. He remained at Wahjain about three weeks, but none of his efforts to bud the Sylhet or Khasi orange were successful. Since then the work of budding has been continued by the staff of the plantation and some success has been attained It may be mentioned that the budding of the Sylhet orange is a matter of some difficulty owing to the large thorn which projects immediately above the bud. Budding was started on January 29th 1909, and since then some 200 buds have been made. Up to date about 20 of these have succeeded, but it is hoped that when the staff of the plantation have had more practice and experience the number of successes will be very much larger. The work will be continued throughout the coming year in order to find out the most suitable season for budding, as this has still to be ascertained in the Khasi Hills.

Receipts and expenditure.

15. The expenditure on the plantation during the year amounted to Rs. 1,068-4-10. and the receipts, almost entirely from the sale of lemon-grass oil, to Rs. 225-2.

Inspection.

1.6 The plantation was inspected twice during the year by the Assistant Director.

SHILLONG ;
The 10th August 1909.

G. P. HECTOR,
Economic Botanist to Government of Eastern Bengal and Assam.

APPENDIX I.

List of Plants at the Tropical Plantation, July 1909.

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
1	Cocoa (*Theobroma cacao*).				
	"Amelando" ...	Grown from Ceylon seed.	August 1904.	2	Out of 20 trees planted in the rains of 1904, only 2 now remain. The tallest of these is about 5 feet high. The cocoa trees are growing too slowly to promise success.
	"Carneas" ...	Ditto ...	August 1904.	2	
	Ditto ...	Ditto ...	Rains, 1905	1	
	"Forestro" ...	Ditto ...	August 1904.	8	One died of drought, December 1908.
	"Candeamar" ...	Ditto ...	Rains, 1904	14	One died of drought, December 1908. Most of the survivors are growing well.
			Total ...	23	
2	Lesser Cardamom (*Elettaria Cardamomum*).				
	"Palni" ...	Palni Hills ...	June 1904	4	
	Ditto ...	Grown from seed, procured from the Palni Hills in Madras.	April 1905	13	The plants are badly attacked by a root fungus and many have died.
3	"Mysore" ...	Plants obtained from Ceylon.	June 1906	3	
			Total ...	20	Clumps.

APPENDIX I—*continued.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
4	Greater Cardamom (*Amomum Subulatum*).	Plants obtained from the Lloyd Botanical Garden, Darjeeling.	June 1906	2	The original plants were put down in June 1904, but these have all died of disease. The present plants were obtained by breaking up the old clumps.
	Ditto ...	Plants obtained from Shillong.	,, 1908	26	74 clumps died of drought.
			Total ...	28	Clumps.
5	Nutmeg (*Myristica fragrans*).	From Ceylon seed	April 1905	18	Only 18 have survived out of 60 seedlings planted in 1905. The plants are still very small, and are growing very slowly.
6	Cinnamon (*Cinnamomum Zeylanicum*).	Ditto ...	Ditto ...	22	The 22 clumps contain 68 plants. They are making good growth.
7	Khasi (*Cinnamon*)	Locally procured...	September 1907.	9	
8	Camphor (*Cinnamomum Camphorum*).	Plants from Ceylon	July 1904	9	Growing beautifully. The plants are bushy and displaying an exuberant growth.
9	Coffee (*Coffea Arabica*).	Locally procured	May 1904	28	Growing very well. Most of the trees are now in bearing.
	Ditto ...	Ditto ...	April 1906	323	Growing well. Most of the trees of 1905 and 1906 are now in bearing. During the past year a crop of ten seers was obtained.
	Ditto ...	Ditto ...	June 1906	498	
	Ditto ...	Ditto ...	,, 1907	122	
	Ditto ...	Ditto ...	,, 1908	106	
	Ditto ...	Ditto ...	May 1909	36	
			Total ...	1,103	

APPENDIX I—*continued.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
10	Orange (*Citrus Aurantium*).				
	"Victoria Mammoth" or "Natal."	Natal	April and June 1904	9	Growing remarkably well. Three trees flowered last spring and one bore fruits.
	"Jamaica" ...	From Jamaica seed	June 1907	12	Growing well.
	"Malta" ...	Lahore ...	April 1906	4	Ditto.
	"Khasia" ...	Local ...	June 1904	50	Growing very well.
	Ditto ...	Ditto ...	„ 1906	441	Growing well.
	Ditto ...	Ditto ...	„ 1908	250	
			Total ...	766	
1	Citrus of different species—				
	"Malta Citron"	Cutting from a tree in the abandoned Government citrus plantation at Therriaghat.	Summer, 1905.	4	Growing well.
	"Soh-mad" (*citron*).	Ditto ...	Ditto ...	24	Making fair growth.
	"Soh-myndong"	Ditto ...	Ditto ...	22	
	"Soh-kwit" ...	Ditto ...	Ditto ...	23	
	"Soh-myngor" ... (*pummelo*).	Ditto ...	Ditto ...	17	
	"Soh-niamriang"	Ditto ...	Ditto ...	17	
	"Soh-pai" ...	Ditto ...	Ditto ...	24	
	"Soh-khyllah" ...	Ditto ...	Ditto ...	10	
	"Soh-thang" ...	Ditto ...	Ditto ...	13	
	"Soh-syiang" ...	Ditto ...	Ditto ...	21	

APPENDIX I—*continued.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
11	Citrus of different species *erected.*—				
	C. Decumana ...	Japan ...	June 1907	2	Making poor growth.
	C. Medica Chiro-Carpa.	Ditto ...	Ditto ...	1	
	C. Nobilis saturna	Ditto ...	Ditto ...	2	
	C. Nobilis Kinkuni.	Ditto ...	Ditto ...	2	
	C. Nobilis Umshim	Ditto ...	Ditto ...	1	
	C. Kinkan (round fruit).	Ditto ...	Ditto ...	1	
			Total ...	183	
12	Litchi (grafted) (*Nephelium Litchi*)—	Calcutta ...	June 1904	2	Growing very well. One tree has borne fruit for two years. Some of these were sent this year to the Shillong Show.
13	Mango (grafted) (*Mangifera Indica*).				
	"Fasli" ...	Ditto ...	Ditto ...	2	All growing well. 'Fasli' has flowered and borne one fruit.
	"Langra" ...	Ditto ...	Ditto ...	2	
	"Bombay" ...	Ditto ...	Ditto ...	2	
			Total ...	6	
14	Sapota (*Achras sapota*).	Calcutta ...	June 1904	2	Growing very well. Both have flowered this year.
15	Papaya (*Carica papaya*)—				
	"Bangalore" ...	From garden seed	June 1908	3	Three only survived out of 14 sown in July 1908.

APPENDIX I—*continued.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
16	Pine-apple (*Ananas sativus*), "Ceylon,"	Dibrugarh Jail and suckers from original plants.	Rains 1904, 1906 and 1907.	755	All growing well. About 60 fruits were obtained this year. This pine-apple is of larger size than the country fruits; the eyes are shallow, flesh white, very succulent and of nice flavour, though slightly more sour than the indigenous kinds. The leaves differ from those of country variety in having smooth edges. The variety is expected to be popular.
	Ditto ...	Ditto ...	July 1908	45	
	"Calcutta" ...	From Reporter on Economic Products to the Government of India, Calcutta.	September 1907.	2	
	"Chin" ...	.....	October 1907.	9	
	"Kew" ...	Ceylon and suckers from original.	July 1904 July 1906 July 1907 February 1908.	26	Growing well. The older plants are now in bearing. The quality of the fruit remains to be seen.
			Total ...	837	
17	Plantain (*Musa sapientum*)—				
	Strawberry-flavoured "Bombay."	Empress Botanical Gardens, Poona.	May 1908	10	Growing slowly. The soil is too poor for planting, unless it is planted direct ly after burning the forest. We had two bunches of fruits this year.
					N.B.—Besides these, the plantation contains a large number of Khasi and Assam Valley plantain of several varieties, grown chiefly for the sake of shade. The clumps have become old and are dwindling.

APPENDIX I.—*continued.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
18	Breadfruit (*Artocarpus incisa*).	Ceylon ...	July 1904	1	Growing slowly. One died in December 1908.
19	Mangosteen (*Garcinia Mangostana*).	Ditto ...	April 1907	6	The plants exhibit very little growth and are most unpromising. Some of the plants were attacked by blight and treated with Bordeaux mixture. One died in December 1908.
20	Nam-nam (*Cynometra cauliflora*).	Ditto ...	July 1904	1	These plants were received from Peradeniya for trial. It is not known what the fruits will be like, except in case of *Cochin Goraka*, which is wild in the Assam forests and known as *tepor tenga* in Assam Valley and *dia-pial* in Sylhet. *Ketembella* and *Sandoricum* are growing well. *Nam-nam* and *Cochin* Goraka show very poor growth, and one *Nam-nam* has died during the past year.
21	Sandoricum (*Sandoricum sp.*)	Ditto ...	Ditto ...	1	
22	Ketembella (*Aberia gardeneri*).	Ditto ...	Ditto ...	2	
23	Cochin-Goraka (*Garcinia Xanthochymus*).	Ditto ...	Ditto ...	2	
24	Rambutan (*Nephelium lappaceum*).	Plants from Ceylon	Jul 1904	7	The plants are growing slowly. The tallest is 8′ to 9′ high.
	Ditto ...	Raised from Ceylon seed.	April 1905	2	
			Total ...	9	
25	Soursop (*Anona muricata*).	Plants from Ceylon	July 1904	7	Growing fairly well. They have been attacked by blight and sprayed with Bordeaux.
		Raised from Ceylon seed	April 1905	15	
			Total ...	22	
26	Betel-nut (*Areca Catechu*).	Local ...	1905 ...	190	This number has survived out of some five hundred planted in 1905 along the boundaries of fields A, B, C, and E. They are growing very slowly.
27	Betel-leaf (*Pan, Piper betel*).	Ditto ...	August 1904	3	These have survived out of 30 plants planted in 1904 and 100 in 1905. Growing well. Being grown for observation and study.
			June 1905	29	
			Total ...	32	

APPENDIX I.—*concluded.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
28	Cashew nuts ...	Raised from seed...	June 1903	129	These have survived out of 30 plants planted in 1904 and 109 in 1905. Growing well. Being grown for observation and study.
29	Black pepper (*Piper nigrum*).	Local ...	August 1904	5	These have survived out of 236 seedlings sown in June 1903.
			June 1905	28	
			Total ...	33	
30	Lemon-grass (*Cymbopogon citratus*).	From three distinct sources, viz. :—	See column 3.	Area, Sq. ft.	
		(1) Ceylon under name of lemon-grass in April 1905.	.....	15,671	
		Ditto ...	1907 ...	7,350	
		Ditto ...	1903 ...	4,428	
		(2) Tyrna in August 1904; name not known.	.....	85,972	
		(3) Moriani, Assam Valley, in December 1904; name not known.	.....	31,826	
		Ditto ...	.....	83	
	Lemon-grass (*C. flexuosus*).	Cochin under name of lemon-grass in June 1906-1907.	.....	5,073	Not yet fit for distillation.
		Ditto ...	1903 ...	2,000	
			Total ...	159,505, or 3·51 acres, containing 5,978 clumps fit for distillation.	

APPENDIX II.

Plants distributed from the plantation during the year ending 30th June 1909.

Names of Plants.	Number of plants.	Number of persons.
1	2	3
Orange seedlings	1,212	7
Ceylon pine-apple (suckers)	60	7
Tyrna grass (rootlets)	25	3
*Cochin grass (rootlets)	30	2
Ceylon grass (rootlets)	30	2
Moriani grass (rootlets)	30	2
Total ...	1,387	23

*4 chittaks seed of Cochin grass was also distributed.

SHILLONG : Printed and published by E. HILL, Superintendent, Eastern Bengal and Assam Government Printing, (Agri.), No. 91—710—2-3-1910.

SHILLONG: Printed and Published by E. HILL, Superintendent, Eastern Bengal and Assam Secretariat Printing Office: (Agri.) No. 91—710—15-3-1910—GAN. K.

ANNUAL REPORT OF THE AGRICULTURAL STATIONS

IN

EASTERN BENGAL AND ASSAM

FOR THE

Year ending the 30th June 1910.

SHILLONG:
PRINTED AT THE EASTERN BENGAL AND ASSAM SECRETARIAT PRINTING OFFICE.

1910.

Price 1 *Shilling.*] [*Price* 12 *annas.*

Agents for the sale of Books published by the Eastern Bengal and Assam Government.

Agents in India.

(1) Messrs. Thacker, Spink & Co., Calcutta.

(2) Messrs. W. Newman & Co., Calcutta.

(3) Messr. S. K. Lahri & Co, Calcutta.

(4) Messrs. A. M. and J. Ferguson, Ceylon.

(5) Messrs. R. Cambray & Co., 6, and 8/2, Hastings Street, Calcutta.

(6) Messrs. Thompson & Co., Madras.

Agents in England.

(1) Mr. F. Arnold, 41 and 43, Maddox Street, Bond Street, W., London.

(2) Messrs. Constable & Co., 10, Orange Street, Leicester Square, W. C.

(3) Messrs. Kegan Paul, Trench, Trübner & Co., 43, Gerrard Street, Soho, W., London.

(4) Mr. B. Quaritch, Gralton Street, New Bond Street, W.

(5) Messrs. P. S. King & Son, 9, Bridge Street, Westminster, S. W., London.

(6) Mr. B. H. Blackwell, 50 & 51, Broad Street, Oxford.

(7) Messrs. Deighton Bell & Co., Cambridge.

(8) Messrs. Henry S. King & Co., 65, Cornhill, E. C., London.

(9) Messrs. Grindlay & Co., 54, Parliament Street S. W., London.

(10) Mr. T. Fisher Unwin, 1, Adelphi Terrace, London, W.C.

Agents on the Continent of Europe.

(1) MM. Friedländer & Sohn, 11, Carlstrasse, Berlin.

(2) M. Otto Harrassowitz, Leipzig.

(3) M. Karl Hiersemann, Leipzig.

(4) M. Ernest Leroux, 28, Rue Bonapar Paris.

(5) Martinus Nijhoff, The Hague, Holland.

(6) Mr. Rudolf Haupt, Halle-a-S., Germany.

SHILLONG :
PRINTED BY E. HILL, PRESS SUPERINTENDENT, E. B. AND ASSAM.

CONTENTS.

ANNUAL REPORT OF THE DACCA AGRICULTURAL STATION.

	Pages.	Paras.
Map of Dacca.		
History, description, laying out and equipment	1—6	1—7
Experimental cultivation—high land improvement experiment; manurial experiments with winter paddy; planting and spacing experiment with winter paddy; trial of rhea, linseed and wheat; inoculation experiment with peas and oats ...	6—11	8—13
New experimental cultivation—*dhaincha*, *aus* paddy, maize, rhea, sugarcane, jowar, mustard, etc. ...	11—13	14
Miscellaneous	13—15	15—18
Appendix:—Programme of work for 1910—1911.	17—18	

ANNUAL REPORT OF THE BURIRHAT AGRICULTURAL STATION.

Map of Burirhat,		
History, description and equipment ...	21-24	1-5
Season	24-26	6
Crops grown during the year ...	26-27	7
Tobacco experiments	28-46	8-14
Valuation of tobacco samples ...	46-47	15-17
Other crops	47-51	18-26
Supply of seeds	51	27
Implements	51-53	28
Miscellaneous	53-34	29-32
Appendix:—Report received from the India Trade Enquiry Office on the result of the examination of tobacco	55-58	

ANNUAL REPORT OF THE RAJSHAHI AGRICULTURAL STATION.

	Pages.	Paras.
Introduction...	59	1
Season	*ib.*	2
Experiments of the year—winter rice; jute; sugarcane; potatoes; oats; mustard and other crops ...	59-63	3—10
Miscellaneous	63	11—13

ANNUAL REPORT OF THE JORHAT AGRICULTURAL STATION.

Map of Jorhat		
History, description and equipment ...	65-66	1-4
Rainfall	66	5
Experiments of the year	67	6
Sugarcane experiments	67-77	7-10
Lime experiment	77-78	11
Other crops	78-79	12-13
Fruit trees	79-80	14
Miscellaneous	81	15-17
Appendix :—Programme of work, 1909-1910	81-82	

ANNUAL REPORT OF THE SHILLONG FRUIT EXPERIMENT STATION.

Introductory, history and description ...	83—84	1—2
Number of fruit trees	84—85	3
Weather	86	4
Pregress of fruit trees	86—90	5
Treatment of fruit trees	90—91	6
Mr. Proudlock's visits	91	7
Strawberries, rhubarb and asparagus ...	91—92	8
Groundnut	92	9
Sericulture	93—94	10
Miscellaneous	94—96	11—12
Statement showing the number and description of fruit trees ...	97—118	...

ANNUAL REPORT OF THE UPPER SHILLONG AGRICULTURAL STATION.

	Pages.	Paras.
Introductory, history and description ...	119—120	1—2
Weather	120	3
Work done during the year ...	120—121	4
Potato experiments	121—130	5—9
Cultivation of potatoes for seed ...	130—131	10
Trials of oats	131—132	11
Trials of clovers and grasses ...	132—133	12
Trials of other new crops—flax—New Zealand flax and Chinese soy bean	133—134	13
Growing of fodder crops for silage and hay	134—135	14
Cattle breeding	135—137	15
Sheep breeding	137	16
Miscellaneous	137—138	17—18
Appendix:—Agricultural demonstrations in the Khasi Hills. ...	139—143	...

ANNUAL REPORT OF THE WAHJAIN AGRICULTURAL STATION.

History and description	145	1
Soil	145—147	2
Climate	147	3
Character of the Season	148	4
Work done during the year ...	149—152	5
Plants under trial—Camphor, Coffee, Cinnamon, Nutmeg, Cardamoms, etc.	152—153	6—12
Receipts and expenditure	153	13
Inspection	*ib.*	14
Appendix I	154—160	...
Appendix II	161	...
Appendix III	162	...

MAP
OF
DACCA CENTRAL FARM

ANNUAL REPORT OF THE DACCA AGRICULTURAL STATION FOR THE YEAR ENDING 30TH JUNE 1910.

Introduction.

The farm is situated about five miles north of Dacca town, and has a total area of 353·7 acres. The land was acquired in 1906. At the time of acquisition the greater portion was covered with jungle and coarse grass.

The farm will be the main experiment station of the province, and is also the headquarters of the superior staff of the Department. The laboratory and officers' bungalows have been completed and all the officers are now in residence.

Land.

3 *bighas*=1 acre (approximate).

2. There are three distinct types of land on the farm :—

(1) High land (about 860 *bighas*),

(2) Open lowland (about 35 *bighas*),

(3) Ravine land or *holas* (about 173 *bighas*).

The high land forms the greater portion of the farm. It is composed of a stiff red clay soil, the chief characteristic of which is the rapidity with which it loses its moisture and becomes hard and dry. It appears to be extremely deficient in organic matter. Before we acquired this land most of it was under jungle. Dotted here and there were the houses of a few cultivators, who grazed their cattle in the jungle and took crops of winter paddy from the surrounding *holas*. A few patches of *aus* paddy, *til* and mustard were also grown on the high land by the cultivators, but their chief means of livelihood was the cultivation of winter paddy in the *holas*.

The open lowland usually goes under water some time during the rains, and in a normal season jute can be grown followed by winter paddy. This land is from 2 to 3 feet below the general level of the high land ; the soil is on the whole in better condition than that of the high land, as it receives some of the washings from the high land.

The ravine lands or *holas* wind in and out amongst the high land, cutting it up into irregular shaped blocks. Never more than about 150 feet wide ; they vary in depth from 2 or 3 feet up to 8 or 10 feet. This land has been cropped by the raiyats with winter paddy for generations, practically

without manure, the fertility being sustained by washings from the high land and by the growth of leguminous weeds which are brought up by the early rains in the spring.

The farm, on the whole, may be said to be representative of a large jungle tract cut up by ravines and extending northward from the Dacca town. In this jungle are scattered villages, the occupants of which regularly cultivate winter paddy on the low land and *bolas*. The high land is uncultivated, except small patches here and there where the villagers grow good crops of *aus* paddy and *til* in the rains. As soon as the rains come to an end, the land sets like a brick, so the local raiyats for the most part let *rabi* cultivation severely alone. A little *mung*, *matikalai* and mustard is cultivated in patches, but most of the high land is bare during the cold weather.

The plan of the farm inserted in this report, will give some idea as to the distribution of the land. Most of the high land is very uneven in character, so it has been laid out in large blocks, which will be cropped uniformly as far as possible until we are able to select plots of approximately equal fertility for experiment.

Work done during the year.

3. In view of the fact that the high land is so uneven in character that for some years to come it will not be fit for experiment, the experimental work was confined mainly to winter rice in the ravines where the land is more even in fertility. Most of the high land is being cropped without manure, except green manure, with the object of bringing it into a fit condition for experimental work. To test our progress in this respect the land has been divided into *bigha* plots and a record is being kept of the produce of each plot. There are no actual divisions between the plots, but pegs have been fixed on the boundaries of the fields so that by setting out lines between opposite pegs we are able, at harvest time, to lay out the whole field in square *bighas*.

Details of the work done during the year under report will be given under the following heads:—

(*a*) Reclamation of new land.
(*b*) Draining and road-making.
(*c*) Building.
(*d*) Reclamation of tanks.
(*e*) Experimental cultivation.
(*f*) Non-experimental cultivation.

Reclamation of new land.

4. During the year about 80 *bighas* more high land were brought under cultivation. Most of this was under jungle and rough grass, but about 25 *bighas* was land which had at some time been cultivated, but which had been allowed to go down to pasture. The jungle land, after clearing, had to be roughly levelled with the *kodali* before ploughing was possible, but in the case of the pasture land this was unnecessary except in a few places, so the land was ploughed without preliminary levelling. All the new land was broken up with the English Turnwrest ploughs, which were mentioned in the previous year's report as having been imported. Afterwards, the land was prepared for sowing with the ordinary country plough.

At present, the land of the farm is divided approximately as follows :—

	Bighas.
High land under cultivation...	412
Open lowland under cultivation	35
Ravines under cultivation	173
Paddock for cattle	10
Mango-groves	87
Botanical area and poultry runs	67
Tanks	54
Sites of buildings, roads, drains, etc., ...	153
Unreclaimed land, most of it under jungle and thatching grass	79
Total	1,070

Road-making and draining.

5. The metalling of the main road from the entrance of the farm to the farm buildings, was completed during the year by the Public Works Department. A length of road running along the south boundary of the Sunti tank to the main road, was metalled departmentally at a cost of Rs. 765.

The drainage of the Sunti, Agirgaon and Mastul blocks was much improved by cutting a deep drain on the east of the Mastul block leading into the Khoshkhana ravine.

Another drain was cut along part of the northern boundary of the farm to drain the land in the vicinity of the farm buildings. The total amount spent on drainage was Rs. 150.

Building work.

6. The Seed Depôt Superintendent's quarters and the three blocks of clerks' quarters, which were mentioned in the previous year's report as being under construction, have been completed, and in addition quarters for the Seed Depôt clerk, Entomological Collector and a block of four quarters for apprentices were erected during the year. It is proposed to build other quarters for the Entomological Collector near the Laboratory Assistants' quarters and, when these are completed, to take the existing Entomological Collector's quarters for the farm clerk.

Extensive alterations and improvements have been made in the farm buildings. The former cattle shed was badly planned and a good deal of space was wasted. The patent stone floor was a source of danger to the cattle, as it was extremely slippery when wet. To remedy these defects we replaced the patent stone floor in the western cattle shed with brick-on-edge. The trough was entirely dismantled and a partition erected down the middle of the shed, so that now there is ample room for a double row of cattle instead of a single row as before. The shed will now hold 32 pairs of bullocks whereas, before the alterations, it would only take 16 pairs. The cost of the alterations was Rs. 1,000.

The northern cattle shed has been converted into a godown for the Seed Depôt by dismantling the trough and closing up the two sides of the shed with corrugated iron walls at a cost of Rs. 1,000.

Two of the godowns which were floored with brick-on-edge were re-floored with patent stone over a layer of cinders, at a cost of Rs. 500 and Rs. 450, respectively. Before this, they were damp in the rains, but since patent stone has been substituted for brick-on-edge, they have kept perfectly dry.

The southern godown has been entirely re-arranged; a portion of it has been taken in to enlarge the workshops and the remainder is now split up into three portions by partitions and includes small lockup godowns for cattle food and implements and a shed, open on one side, for storing the larger farm implements. These alterations were carried out by the farm *mistris* at a trifling cost.

A threshing floor 75′×75′ was laid down to the north of the farm buildings. It is constructed of brick-on-edge over one brick flat at a cost of Rs. 1,450.

A list of the buildings now completed on the farm is given below :—

1. Farm buildings, comprising cattle shed, godowns, seed depôt, office, workshops and quarters for chaukidar and two cattle men.

		Rs.	
2. Agricultural Supervisor's quarters	...	2,500	
3. Farm Superintendent's quarters	...	2,000	
4. Seed Depôt Superintendent's quarters	...	2,300	
5. Two Overseers' quarters ...	...	650	each.
6. Fieldman's quarters ...	...	650	
7. Seed Depôt clerk's quarters ...	...	750	
8. Entomological Collector's quarters	...	750	
9. Two blocks of apprentices' quarters	...	500	each.
10. Three blocks of quarters for Laboratory clerks and fieldmen (two quarters in each block).		1,500	each.

During the current year we propose to erect the following buildings for the Laboratory staff :—

	Rs.
Three first Assistants' quarters	1,800 each.
One second Assistant's quarters	1,200
Mycological Collector's quarters	1,000
Entomological Collector's quarters	1,000
Two clerks' quarters	750 each.

Two blocks of eight quarters each for Laboratory servants, peons, etc.

The present quarters of the Entomological Collector will be handed over to the farm clerk when his new quarters are completed. The above work has been put in hand and will be finished during the current financial year.

Reclamation of tanks.

7. The excavation of the Sunti tank was completed and its banks dressed and levelled during the year. A *pucca* foot-path 4 feet wide is now being constructed round the north and east sides of the tank in front of the quarters of the farm staff. It is intended to lay down *Dub* grass on the banks of the tank during the current rainy season.

Two smaller tanks, *viz.*, the Hazi and Shati require re-excavation, but up to the present we have not been able to

take up the work, as our funds have been required for more urgent work.

Experimental cultivation.

8. This included :—

(*a*) An experiment on the improvement of the high land.

(*b*) Manurial experiments with winter paddy.

(*c*) Planting and spacing experiment with winter paddy.

(*d*) Trial of rhea, linseed and wheat.

(*e*) *Nitro-Bacterine* inoculation experiment with peas and oats.

High land improvement experiment.

9. This was mentioned in the previous year's report as having been commenced in the spring of 1908. It was designed to ascertain the best method of improving the heavy clay soil of the high land. No results worthy of publication have been obtained up to date.

This year the experiment has been remodelled. It now consists of four plots each $1\frac{2}{3}$ acres in area on the typical high land of the farm. Two of the plots will be cropped with *aus* paddy or jute in the *kharif* season followed by a leguminous crop (*mung* or *matikalai*) in the *rabi*. The rains crop will receive a light dressing of cowdung on one plot and an equivalent amount of decayed organic matter (vegetable rubbish) on the other.

The two remaining plots will be green manured in the rains, one with *dhaincha* and the other with *sann*, followed by a non-leguminous crop in the cold weather. The above scheme will be tried for two years. A strict account is being kept of the expenditure incurred and the value of the crops obtained and we hope in the course of time to gain some information as to whether or not it pays on this land to lose the *kharif* crop for the sake of the improvement in the soil due to green manuring. This experiment would have been extended by other plots green manured in alternate years, but at present there is no more suitable land available.

Winter paddy, manurial experiments.

10. The manurial experiments in the Eastern ravine commenced in 1908, was repeated on the same plots in 1909. During the current year we are cropping all the plots without manure to ascertain the residual value, if any, of the manures It has

been decided to discontinue the use of soluble manures, such as saltpetre, on this class of low land owing to the difficulty of controlling the drainage water. We are convinced that much of the value of this experiment has been lost through the more soluble manures having been washed to some extent from one plot to another by heavy rain storms, which are liable to temporarily flood the plots on this ravine land, but since the experiment is to be discontinued, we give in the following table the results of the two years side by side, although the results of the plots treated with the soluble manures should be accepted with a certain amount of reservation on account of the above facts.

Per acre—average of duplicate plots.

Manuring.	1908.					1909.					Average of two years.					Remarks.
	Yield.		Value.	Expenditure.	Profit.	Yield.		Value.	Expenditure.	Profit.	Yield.		Value.	Expenditure.	Profit.	
	Grain.	Straw.				Grain.	Straw.				Grain.	Straw.				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Mds. srs.	Mds. srs.	Rs. as.	Rs. as.	Rs. as.	Mds. srs.	Mds. srs.	Rs. as.	Rs. as.	Rs. as.	Mds. srs.	Mds. srs.	Rs. as.	Rs. as.	Rs. as.	
Green-manured (*Dhaincha*) ...	25 33	34 27	84 0	34 13	49 13	22 9	29 24	68 8	38 0	30 8	24 1	32 5	76 4	36 6	39 14	Paddy valued at Rs. 3 per maund in 1908 and Rs. 2-12 per maund in 1909. Straw at As. 3 per maund in 1908 and As. 4 in 1909. (Actual market price).
Ditto, *Sann* Hemp ...			failed.			14 5	17 21	43 3	38 10	4 9	...	...	...	...	...	
Unmanured	16 26	34 17	66 6	32 5	24 1	17 29	17 6	53 0	36 0	17 0	17 7	25 31	54 11	34 3	20 9	
Bone-meal 3 maunds	25 11	62 17	87 9	44 3	43 6	24 6	27 0	72 12	44 0	28 12	24 6	44 29	60 3	44 2	36 1	
Bone-meal 3 maunds and saltpetre (30 seers per acre).	25 9	51 24	85 6	49 13	35 9	21 29	29 17	67 1	52 2	14 15	23 19	40 21	76 4	51 0	25 4	
Bone-meal 3 maunds and ammonium sulphate.	26 29	52 34	90 1	48 11	41 6	18 17	29 20	68 0	61 1	6 15	22 23	41 7	74 1	49 14	24 3	
Bone-meal 3 maunds and Calcium Nitrate.	27 15	48 15	91 3	48 14	42 5	25 30	27 28	77 12	52 11	25 1	26 23	38 1	84 8	50 13	33 11	
Bone-meal 3 maunds and cotton seed.	28 26	53 31	96 13	48 15	47 14	19 7	24 31	58 15	50 2	8 13	23 37	39 11	77 14	49 9	28 5	
Bone-meal 3 maunds* ...	31 0	64 3	105 1	42 11	62 6	21 25	31 15	67 6	43 10	23 12	26 13	47 29	86 4	43 3	43 1	
Fish manure	26 28	52 30	89 14	37 4	52 10	18 4	13 1	54 5	37 1	17 4	32 15	35	72 2	37 3	34 15	
Unmanured	25 32	47 26	86 5	29 6	56 15	16 34	15 30	50 4	32 12	17 8	21 15	33 28	68 5	31 2	37 3	
Average of all bone-meal plots ...	28 6	53 13	96 5	43 7	52 14	22 20	29 7	70 1	43 13	26 4	25 13	46 8	83 3	43 10	39 9	

* Cotton cake should have been added to the bone-meal on this plot, but it was unobtainable.

The amounts of fish manure, Sulphate of Ammonia, Calcium Nitrate and cotton seed applied, contained nitrogen equal to that contained in 30 seers saltpetre.

The *dhaincha* and *sann* were sown in April and ploughed in about the middle of July. The *sann* was a failure in 1908 and was not very promising in the following year. The *dhaincha* in both years was only about a foot high when it was ploughed in.

In 1908 the bone-meal was applied in the beginning of May and in 1909 in the middle of April. The cotton seed (crushed) and the fish manure were puddled into the land in July. Paddy was transplanted in the first week of August 1908 and in the third week of August 1909. The soluble manures were applied as top dressings in September 1908 and October 1909 after the seedlings had become well established. In both years the plots were damaged to some extent by insects.

On examination of the results it will be noticed that the weights of straw in 1909 are only about half that of 1908. This is not altogether due to the ranker growth of the crop in 1908, but can partly be accounted for by the fact that the weather at the time of harvest was very much drier than in 1908 and thus the straw was drier when weighed. On the whole, the results of the two years seem to indicate that bone-meal applied alone is much more profitable than when a soluble *nitrogenus* manure is added to it.

The plots green manured with *dhaincha* have come out remarkably well, considering that the *dhaincha* was such a poor crop. If by early sowing, a really good crop of *dhaincha* could be obtained there is every indication that green manuring would be the cheapest manure for paddy on this land. Bone-meal has also shown itself to be profitable and is to be recommended when cowdung is unobtainable and green manuring cannot be done.

In the Khoskhana ravine a small experiment was commenced to contrast the effects of green manure and cowdung against no manure on winter paddy. The experiment consists of six plots, two of which were dressed with 150 maunds of cowdung per acre, two were green manured with *dhaincha*, and two were untreated. The growth of the *dhaincha* was very poor. We propose to sow it earlier in future, if possible. We do not propose to give any figures

for this experiment until it has been repeated, since the *dhaincha* did not get a fair trial, but the first year's results indicate that, on this land, the effect of cowdung tends to very largely increase the amount of straw without affecting the yield of grain.

Planting and spacing experiment with winter paddy.

11. The local practice in transplanting winter paddy is to plant bunches of seedlings from 8″ to 12″ apart, with from 2 to 6 seedlings in a bunch. The earlier the paddy is planted the less is the number of seedlings used. Very late paddy is planted in large bunches and at closer distances. In order to ascertain whether the number of seedlings could not be reduced and also whether the crop would not be benefited by planting a less number of seedlings in a bunch an experiment was laid down in the Tilbisra ravine and duplicated in the Jalabisra ravine. It consists of a series of 12 plots. The seedlings were planted at 8″, 10″ and 12″ apart and at each distance, one, two, three and four seedlings in a bunch were tried. The experiment will be repeated for several years in succession. Until we have compared this year's result with at least one more year's result, we do not think it would be advisable to give any results in figures. For the present it will be sufficient to say that this year's results are exceedingly promising and indicate that thinner planting can safely be practised without diminution of crop. There is also every indication that thinner planting will tend to improve the size of the grain and produce a better quality of paddy.

The question of the number of seedlings per acre is extremely important when you consider that if the number of seedlings can safely be reduced by one half, the area of the seedbed, and what is more important still, the seed rate will be reduced in a like proportion.

Other experimental crops.

12. *Rhea.*—About a *bigha* of high land was planted with *Rhea* for trial in October last. The land was manured with 10 maunds of oil-cake per acre. A large number of the plants died out during the cold weather, but about one-third of the area has survived. It was top-dressed with another 10 maunds of cake in May and is now doing fairly well.

Linseed for flax was tried on two pieces of land, each about a *bigha* in area. Both of the plots looked promising in the early stages of growth, but the plants suffered from lack of moisture and the crop was useless for flax fibre. The crop was allowed to ripen, but only a very poor crop of linseed was obtained.

Wheat was tried on about a *bigha* of land but failed entirely, dying off soon after germination.

Inoculation experiment with peas and oats.

13. This experiment was tried on one *bigha* of oats and one of peas. The whole area was manured with 100 maunds of cowdung per *bigha* and half of each plot received a dressing of 15 maunds of lime per *bigha*.

Special cultures of *Nitro-Bacterine* for peas and oats were obtained from England. The seeds were first inoculated and then sown in the beginning of November. After the crops had germinated, the land was also inoculated with water, containing cultures of the Bacteria. The experiment was a complete failure. The crops of peas and oats were so poor that they were not worth weighing and were fed to cattle. Both peas and oats grew a little better on the limed portions of the plots. The peas were examined for *nodules* at several stages of their growth, but none were discovered.

Non-experimental cultivation.

14. In previous years owing to lack of sufficient bullocks and equipment all the non-experimental area on the farm, which had been cleared, was let to surrounding raiyats, but in the previous year all the land was taken over and cultivated by ourselves. Thus this report deals with our first year's cropping.

The general idea of the high land cropping scheme was to green manure all land in the *kharif* season which had been cropped previously and to follow this with a non-leguminous crop; whereas a crop of *aus* paddy was to be taken from all newly reclaimed land in the *kharif* season followed by a leguminous crop in the *rabi* season. This scheme was as far as possible carried out.

Kharif cropping—*Dhaincha* was sown for green manure in Hazi north and south, Santi, Mastul, and part of Shati west; Sann hemp was tried in Shati east.

Aus paddy was grown without manure in Agirgaon and Mirpur central and south; the total area being 76 *bighas*. The total produce amounted to 308 maunds of paddy

which works out at 5 maunds (nearly) per *bigha*. The different fields varied somewhat in yield—Mirpur central gave 5 maunds, Mirpur south nearly 7 maunds, while Agirgaon gave only 4 maunds per *bigha*.

Maize and Rahar.—19½ *bighas* of maize and *rahar* mixed were sown in Mirpur north. Most of the maize was cut and fed to the cattle. The *Rahar* yielded only about 43 maunds of grain.

Sugarcane.—About two *bighas* of local *Ganderi* variety was grown. The land was manured with 300 maunds of cowdung per acre and the sets planted at the beginning of May. The crop was afterwards top-dressed with about 7½ maunds of cake per acre. The crop grew well, but appeared to be suffering from lack of moisture in the cold weather. It could not, however, be irrigated. A certain proportion of the crop was distributed for seed, and the rest was sold. The area is being ratooned this year.

Jowar was grown on the whole of the office field Most of it was cut and fed green to the cattle, but a small amount was made into a stack silo, which was not very successful.

Rabi cropping.—*Til* was grown in Shati east, Shati west and Hazi south on a total area of 58 *bighas*. The yield was poor, only amounting to about 73 maunds for the whole area.

Mustard was sown in Hazi north. The germination was good, but most of the young plants turned a bluish colour soon afterwards and died out. The crop was a failure except for a few patches here and there. *Mung* was grown on 19 *bighas* in Mirpur south and also in Mastul. The crop in Mastul did not grow well and was not worth harvesting, so it was grazed with cattle. The other 19 *bighas* yielded only about 27 maunds of grain.

Mati Kalai was grown in Mirpur central, Sunti west and Agirgaon. A yield of 36 maunds was obtained from 44 *bighas* in *Mirpur*, but the crop in the other fields was not good enough to harvest; so was grazed off with cattle.

Ravine and lowland cropping.—All the land not under experiment was cropped with sixteen good varieties of winter paddy. The total area was 171 *bighas* and the total yield 1,380 maunds of paddy.

A dozen of the best varieties were planted with single plants one inch apart on small plots. These were handed over to the Economic Botanist for selection work.

Establishment.

15. The sanctioned establishment consists of:—

1 Superintendent (Agricultural Supervisor) on Rs. 250-10-400.

2	Overseers	„ Rs. 30-2-50 each.
1	Fieldman	„ Rs. 25-1-8-40.
1	Clerk	„ Rs. 25-1-8-40.
1	Blacksmith	„ Rs. 38.
1	Carpenter	„ Rs. 20.
8	Apprentices	„ Rs. 15 each.
1	Darwan	„ Rs. 10.
1	Peon (Agricultural Supervisor's)	„ Rs. 8.
1	Peon (Farm)	„ Rs. 8.
2	Chaukidars	„ Rs. 8 each.

There is also an extra overseer sanctioned for two years on Rs. 30, who is being employed in building and surveying work. Four new apprentices were appointed during the year bringing up the total to eight. These young men are the sons of cultivators who are being trained for demonstration work. The training extends to two years, during which time they are instructed in the laying out of plots and the conduct of experiments generally. They are taught the use of improved implements and take part in all the manual work of the farm. The only educational qualification required is that they should be able to read and write their own language. A knowledge of English is not regarded as a special qualification. After completion of their training, if they are considered suitable, it is proposed to employ them in demonstration work under the guidance of Agricultural Supervisors.

There are also a few young men, sons of cultivators, who are working on the farm as ordinary labourers in anticipation of being appointed to apprenticeships when vacancies occur.

Cattle.

16. In November last 12 more pairs of bullocks were purchased by the Veterinary Superintendent at Sonepur, at a cost of Rs. 1,455, inclusive of freight and other charges. This brings up the total

number of work cattle to 30 pairs at present on the farm. Two bullocks died during the year and one was disabled and had to be sold.

17. In addition to the ordinary local country implements we have the following in use on the farm :—

Implements.

Ransome's Turnwrest ploughs.

Hindustan ploughs.

Meston plough.

Rajeswar plough.

Bihar seed drills.

Drag harrows.

Bullock hoes (Bakhar).

The Turnwrest ploughs have been found especially useful in breaking up new land and ploughing in green manure. We have tried two types, the B. T. and C. T. The C. T. is the larger one and we have found it more useful than the other. It takes two pairs of good bullocks to work it and will cultivate from 6″ to 9″ deep according to the state of the land. In fairly loose soil nearly an acre can be ploughed in a day, but the average area ploughed on the stiff clay soil of the farm is about two *bighas* or about two-thirds of an acre. The price of this plough is Rs. 24, excluding freight. If half a dozen are imported together, the price of each including freight, would amount to about Rs. 30. The smaller plough B. T. does not take so much draft and can be worked with smaller bullocks, but it is not so effective as the other. Its price is Rs. 19-8, exclusive of freight.

The "Arlington" plough (an American make) mentioned in the previous years' report, has been found to be too heavy for two pairs of our bullocks, so its use has been discontinued.

Four more Ransome's Turnwrest ploughs (Mark C. T.) have recently been imported, three for the Department and one for an Assamese gentleman who is growing a large area of sugarcane in Upper Assam.

The Hindustan, Meston and Rajeswar ploughs have been found useful in fairly loose soil, but the heavy clay soil of the farm is rather too much for them. In fact, it is not fair to judge them from their work at the Dacca farm, as the soil is exceptional.

We are trying seed drills, bullock hoes, and drag harrows for the first time this year. All the implements are absolutely new to the province.

Receipts and expenditure.

18. The receipts and expenditure for the year were as follows:—

Receipts—

	Rs.	a.	p.
Fuel	15	6	0
Rent of grazing	12	2	0
Thatching grass	169	12	0
Agricultural produce	3,350	4	9
Miscellaneous	78	4	9
Total	3,625	13	6

Expenditure—

Establishment	7,502	2	7

Capital charges—

Buildings constructed departmentally ...	7,036	14	0
Roads, drains, etc.	2,409	1	7
Excavation of tanks	1,980	0	0
Reclamation of land	1,454	8	3
Live-stock	1,499	15	8
Implements, etc.	829	7	3
Total	15,209	14	9

Non-capital charges—

Labour	6,948	9	6
Purchase and repairs of country implements	341	3	0
Building repairs	569	15	9
Roads, drains, fencing and repairs ...	97	9	6
Seeds, plants and manure	764	1	3
Cattle food	1,084	13	6
Furniture	118	11	0
Stamps	55	4	0
Miscellaneous	534	3	6
Total	10,514	7	0
Grand total	33,226	8	4

APPENDIX.

Programme of work for 1910-1911.

1. *Experimental Winter paddy.*—The series of plots in the manurial experiment in eastern ravine are being cropped this year without manure to ascertain the effect of the manurial residues (if any) of the last two years.

The manurial experiment with cowdung and green manure in the Khoshkana ravine is being repeated with the addition of two more plots which will be treated with slaked lime at the rate of 50 maunds per acre.

Theplanting and spacing experiment described in the report is also being repeated in duplicate.

A small cultivation experiment will be commenced in duplicate on 6 plots. All the plots will be planted with paddy in the ordinary way. On two of the plots *kheshari* will be sown just before the paddy is harvested. Two plots will be ploughed up directly after the paddy is harvested and the other two plots will be left uncultivated until the following spring. The effect of this treatment will be noted on the following year's paddy crop.

The experiment on the improvement of the high land will be continued on the lines laid down in the report. A *lime experiment* has been commenced on a strip of high land. Half the plot has been dressed with 50 maunds of slaked lime per acre and the other half remains untreated. The present crop is *aus* paddy and it is proposed to follow this with a leguminous crop in the cold weather.

Sugarcane.—About two *bighas* of sugarcane has been planted this year. In addition to the local *Ganderi*, several varieties have been brought from Jorhat (Assam) for trial.

Miscellaneous.—Soybeans, Guinea grass, and a collection of fodder grasses will be tried on small areas.

A collection of fibre plants including *rhea* is being grown under the direction of the Fibre Expert.

An experiment to test the comparative values of *dhaincha*, sann hemp and cowpeas for green manure has been laid down on a piece of land to the north of Mirar Tak.

2. *Non-experimental cropping.—Ravine land.*—The whole of the non-experimental area will be cropped with about a dozen good varieties of winter paddy without manure. A record of the produce of each plot will be kept with the object of standardising the land.

Open Low land.—The open low land in *Sunti* has been put under jute for seed. As the jute will probably not be harvested early enough for winter paddy to be planted, it will be followed by *khesari*. The north Hazi low land is now under *aus* which will be followed by winter paddy.

High land.—Kharif.—In accordance with the scheme explained in the appendix to the previous year's report, the main blocks in the high land have all been laid out in *bigha* plots, and the produce of each *bigha* will be weighed separately.

Hazi north and the non-experimental area in Shoti west, which were green manured in the previous year, have been sown with *aus* paddy and jute, respectively. The whole of Mirpur (the major part of which was newly reclaimed in the previous year has again been sown with *aus* paddy. Agirgaon which grew *aus* paddy in the preceding year has been sown with *dhaincha* for green manuring. Hazi south and Mastul which grew very poor *rabi* crops are being green-manured with *dhaincha* for the second time. The whole of Shati east (with the exception about three acres, which is being used by the Fibre Expert for experimental purposes) has been sown with several of the best varieties of jute for seed. The jute for seed is being grown to supply the Bengal Agricultural Department and also ourselves with seed. The whole of Mustar Tak north has been put under maize and *rahar*. The maize will be harvested for fodder and the *rahar* will be allowed to stand. Mustar Tak south is carrying *rahar* only. *Dhaincha* has been sown in Mirar Tak south for seed. The area reserved for the paddock has been green manured and will very soon be put under *Dub* grass and fenced in. The rest of the office field is carrying a crop of Jowar, with the exception of a small area sown with *dhaincha*.

High land rabi cropping.—In formulating the *rabi* cropping scheme a non-leguminous crop has been, wherever possible, followed by a leguminous crop and *vice versâ* With this view, the whole of Mirpur, Shati east, the non-experimental portion in Shati west as well as the office field, will be sown with *Matikalai*, and Hazi north

will be sown with *mung*. Agirgaon, Mastulbhag, Hazi South and Halibisra (which is being newly broken up) will be sown with local *til*.

Mustard will be grown in Mirar Tak. We are also obtaining a few varieties of the best *til* from Bombay which will be grown in north Mirar Tak. Small areas of wheat oats and peas and linseed will again be tried.

— MAP —
— OF —
— BURIR HAT FARM —

EX. OVERSEER

ANNUAL REPORT OF THE BURIRHAT AGRICULTURAL STATION FOR THE YEAR ENDING 30TH JUNE 1910.

Introductory.

The Farm, which is intended principally for experimental tobacco cultivation, is situated five miles north of Rangpur town, and is about 52 acres in area. The land was acquired in 1907 but no establishment was kept there until the end of July 1908, when the Rangpur Farm establishment removed to Burirhat. A certain amount of preliminary work, such as jungle clearing, building, and road making, had been done, but the real work of the station was not commenced until the establishment had removed there.

Distribution of land.

2. The farm occupies an irregular-shaped piece of land split up by roads into five main blocks, lettered A, B, C, D and E. There is also a small area set apart for a paddock and for the Farm staff quarters. Block E is completely isolated from the rest of the Farm by a road open to the public. The plan prefixed to this report shows the position and size of each block and the crops which it bore during the year.

Soil.

3. The soil is a sandy loam with a sub-soil of almost pure sand which occurs at a depth of 1 to 2 ft. from the surface. The composition of the soil will be seen from the subjoined report received during the year from Mr. H. E. Annett, Offg. Imperial Agricultural Chemist, Pusa, on three samples of soil and three of sub-soil which had been submitted to him in the previous year.

Report on the composition of 6 samples of soil from the Burirhat Farm, Rangpur.

	Block A.		Block D.		Block E.	
	Top 6".	Next 6".	Top 6".	Next 6".	Top 6".	Next 6".
1	2	3	4	5	6	7
Organic matter and combined water	3·21	2·35	3·84	3·44	5·45	4·06
Insoluble silicates and sand	84·07	85·60	81·85	81·98	80·45	80·86
Iron oxide	4·05	3·86	4·62	4·17	4·48	5·04
Alumina	5·64	6·02	6·74	7·54	7·78	7·86

	Block A.		Block D.		Block E.	
	Top 6".	Next 6".	Top 6".	Next 6".	Top 6".	Next 6".
1	2	3	4	5	6	7
Lime	0·14	Nil	Nil	Nil	Nil	Nil
Total phosphoric acid	0·07	0·07	0·11	0·11	0·12	0·11
Potash	0·80	0·77	0·94	0·88	0·86	1·03
Manganese Oxide	Trace	0·09	Trace	0·03	0·03	Nil
Carbonic acid	0·02	0·02	0·01	Nil	0·01	Nil
* Containing nitrogen	0·11	0·06	0·11	0·07	0·05	0·05
Available phosphoric acid	0·049	0·053	0·041	0·039	0·040	0·036
Available potash	0·012	0·006	0·013	0·019	0·019	0·019

These soils are remarkable for the almost complete absence of lime. They apparently will never be any good for cultivation until lime is applied preferably in several small dressings. After liming they should prove very fertile.

Although the soil was so devoid of lime, it did not appear so infertile as one would suppose, except in Block A and part of Block C where the sand lies too near the surface. The cold weather crops grown on these sandy patches suffered from want of moisture and either failed wholly or gave very poor yields. On the rest of the farm, both the *bhadoi* and *rabi* crops grew with luxuriance, though in case of grain crops like *aus* rice, *matikalai* and oats, the yield was not half so good as the growth of the crops led us to expect. The low yield of grain in these cases may be attributed to the want of lime in the soil.

Mr. Meggitt, Agricultural Chemist, visited the farm in May last to investigate the cause of infertility of the soil. He has been furnished with fresh samples of soil and sub-soil for special examination in his laboratory. He too attributes the failure of the *rabi* crops in Block A and part of Block C to sand being too near the surface, and thinks that the use of lime in conjunction with green manuring may lead to an amelioration of the composition of the soil as well as of its power to retain moisture. At his instance an experiment in liming has been started on a piece of land measuring one bigha in the most infertile portion of Block A. Powdered slaked lime has been applied to this land at the rate of

10 maunds per acre, and a similar dose of lime is to be given annually during the next four years, the land being treated in every other respect exactly as the remainder of the block. A similar experiment in liming will be initiated this year in a portion of Block D where the soil, though wanting in lime, is not so poor as in Block A. It is proposed to grow tobacco on this limed area in order to see the effect of liming on the growth and quality of this crop. The barren areas in the different blocks have been surveyed and plotted on a map of the farm for purpose of future reference.

Buildings.

4. The farm was provided in the previous year with a tobacco-curing house, a fermentation house, a combined office and rest-house and a godown. Work was commenced during the year under report on the construction of quarters for the Superintendent of the farm. It will be a pucca building and cost about Rs. 2,200. A barn for the flue-curing of tobacco on the American plan is also under construction and is expected to be completed before the close of the rains ; it is estimated to cost Rs. 600. Several minor works were in process of construction at the end of the year. These include new houses for the coolies and cattle, two corrugated iron latrines for the use of the coolies, covered pits for the preservation of cowdung and a house for storing *bhusa*. A plan and estimate for the construction of the clerk's quarters has just been sanctioned by the Director, and work is about to commence on this house. With the completion of this building and the several houses now under construction, the equipment of the farm will be fairly complete.

Fencing and other works.

5. The fencing of Block E which had been taken in hand in the previous year was completed during the year at a cost of Rs. 1,431-15-9. The total length of the fence which is made of 5 stranded wires set on angle iron standards, 10 feet apart, is 3,226 feet. The wire fencing round the larger area comprising Blocks A, B, C, D, which had been erected in the previous year by the Public Works Department, proved so defective as to make it necessary to have it remade. This was done during the year by the Public Works Department at a cost of Rs. 302.

A *Duranta* hedge was planted in the previous year along the wire fence all round the farm. Blanks in the hedge were replanted during the year. In parts the soil

is either too sandy or too low to suit *Duranta*. In spite of repeated planting, vacancies continue to occur. On the whole, the hedge appears to be coming up very well.

A small area in Block C, which contained the ruins of an indigo factory, was reclaimed and levelled during the year, and a number of bamboo clumps were removed from Blocks B and C. These were the only works of reclamation done during the year.

The boundaries of the farm were demarcated during the year by means of earthenware cylinders, 2 feet long and 6 inches in diameter. A cylinder has been placed at each angle in the boundary, the total number of cylinders used being 30. The cylinders were obtained from Messrs. Burn and Company, Raneegunge, and cost Re. 1 each, excluding cost of transport. Each pillar has the letters B. F. B. (meaning Burirhat farm boundary) stamped on the top end. The boundary marks were placed in position by a *Kanungo* deputed from the local Collectorate.

Season.

6. The rainfall of the last agricultural season, namely, for 14 months from April 1909 to May 1910, is shown in the following table :—

Months.	Actual.		Normal.	
	Rainfall in inches.	Number of rainy days.	Rainfall in inches.	Number of rainy days.
1	2	3	4	5
1909.				
April	3·60	11	3·16	4·3
May	5·56	11	10·37	11·1
June	40·42	22	19·95	15·7
July	6·21	11	15·98	15·4
August	22·12	23	13·02	13·3
September	11·04	14	14·18	13·5
October	7·03	7	4·94	4·0
November	*Nil.*	*Nil.*	0·24	0·1
December	*Nil.*	*Nil.*	0·08	0·2

Months.	Actual.		Normal.	
	Rainfall in inches.	Number of rainy days.	Rainfall in inches.	Number of rainy days.
1	2	3	4	5
1910.				
January	*Nil.*	*Nil.*	0·49	0·9
February	·81	2	0·43	1·1
March	1·76	2	1·6	1·6
Total ...	98·55	93	83·95	81·2
April	0·52	2	3·16	4·3
May	14·30	14	10·37	11·1

The outstanding features of the season were—

(1) Excessive rain in June which damaged the ground-nut crop in the farm by bringing on a severe attack of fungus disease, but left other crops uninjured.

(2) A severe cyclone in October accompanied by heavy rain, which damaged the papaya trees and caused considerable damage to kutcha houses. The weather had been abnormally wet since September and caused great loss of tobacco seedlings in the country round the farm. We were able with great care to save our own seedlings and later on to distribute a large quantity of these among our neighbours. The Superintendent estimates that he gave out a quantity of seedlings enough to plant one hundred bighas of land. The raiyats naturally asked for seedlings of the local varieties, but a few also took some of the exotic kinds.

(3) Complete absence of rain for more than three months during the cold weather. It did not seem to affect the *rabi* crops on the farm except on the areas in which the soil is too sandy. Incidentally it set off very effectively the beneficial effect of green manuring on the water-retaining power of the soil,

(4) strong dry west winds in March followed by a hail-storm, which damaged a small portion of the tobacco crop then in the field.

(5) The weather proved very wet in April 1910 and seriously interfered with the threshing of the oats crop.

7. The crops grown during the year are shown in the following table :—

Crops grown during the year.

Name of crop.	Area in acres.	Blocks in which grown.
1	2	3
Bhadoi.		
Cowpea as green manure	12·00	A and C
Dhanche „	12·82	E
Jowar as fodder	3·70	B
Aus paddy	10·67	D
Matikalai	10·67	D
Groundnut	0·25	C
Total ...	51·11	
Rabi.		
Tobacco	2·36	C
Oats	12·10	E
Oats and pea mixed as fodder ...	3·44	C
Mustard	5·00	A
Potatoes	1·20	C
Total ...	24·10	

The farm contains a small number of Ceylon and Bangalore papaya trees. A few suckers of Ceylon pine-apple were obtained from Wahjain towards the close of the year and planted in a small patch of ground close to the ruins of the indigo factory.

The crops grown are dealt with in the following paragraphs, commencing with tobacco, the main experimental crop of the farm.

Tobacco scheme of experiment.

8. The accompanying table shows the of their cultivation and the methods of curing

Serial No.	Class of tobacco.	Variety.	Source of seed.	Area in acres.	Rotation.	Manure per acre.
1	2	3	4	5	6	7
1	Cigar-l e & f tobacco.	Sumatra	Farm grown seed of 1907-08.	1·00	Green manured with wea	75 maunds of well rotted cowdung per acre.
2	.....	Havana	Ditto ...	·10	Ditto ...	Ditto ...
3	.....	Connecticut seed leaf	Ditto ...	·10	Ditto ...	Ditto ...

varieties of tobacco grown during the year and some particulars followed :—

Time of transplanting.	Date of commencement of harvest.	Mode of harvesting.	Number of leaves kept on a plant.	Mode of curing.	Remarks.
8	9	10	11	12	13
1st to 7th November 1909.	3rd January 1910.	Basal leaves primed; the rest cut whole.	18—20 leaves.	(1) $\frac{1}{32}$th of an acre fire-cured.	The fire-cured tobacco had been damaged in the field by strong dry west wind followed by hail storm which tore up the leaves. The fire-curing proved not very successful.
				(2) $\frac{1}{32}$th of an acre cured in the open.	In sun-curing the plants were cut whole and spread to dry on the grass; when about $\frac{1}{3}$rds cured there was a heavy rain storm at night on 30th March. The tobacco got very wet and turned black. This tobacco will be suitable only for smoking in the Hookka.
				(3) Remainder cured in the barn; of this $\frac{2}{3}$rds was dried in the curing shed and $\frac{1}{3}$rd in the fermentation shed, which latter did not admit of regulation of humidity.	
8th November 1909.	24th February 1910.	Ditto ...	15—17 leaves.	(1) About $\frac{1}{4}$th was cured in the barn.	
				(2) A small portion was fire-cured; but failed to acquire the right colour owing to too rapid rise of heat in the room. The leaves remained green.	
				(3) Another portion which had been reserved for fire-curing was spoiled by high wind and hail; it was cured in the sun.	
8th November 1909.	20th January 1910.	Ditto ...	10—12 leaves.	(1) About half was fire-cured with good result, the leaf having taken a bright yellow colour.	
				(2) Remainder was barn-cured.	

Serial No.	Class of tobacco.	Variety.	Source of seed.	Area in acres.	Rotation.	Manure per acre.
1	2	3	4	5	6	7
4	.....	Pennsylvania ...	Imported from America, 1909.	·02	Green manured with cowpea.	75 maunds of well rotted cowdung per acre.
5	.....	Zimmer Spanish ...	From Pusa Agricultural Research Institute.	·10	Ditto ...	Ditto ...
6	Local Rangpur varieties.	Bhengi	Farm-grown seed.	·30	Ditto ...	Ditto ...
	.....	Naokhai	Ditto ...	·02	Ditto ...	Ditto ...
	.....	Sindur khaina ...	Ditto ...	·02	Ditto ...	Ditto
7	Jalpaiguri varieties.	Paisakhol... ...	From Jalpaiguri	·02	Ditto ...	Ditto ...
	.....	Hargola	Ditto ...	·02	Ditto ...	Ditto ...
8	Chitta gong variety.	Matamauri ...	From farm-grown seed of 1907-1908.	·02	Ditto ...	Ditto ...

Time of transplanting.	Date of commencement of harvest.	Mode of harvesting.	Number of leaves kept on a plant.	Mode of curing.	Remarks.
8	9	10	11	12	13
3rd November 1909.	16th February 1910.	Cut whole ...	7—8 leaves.	Barn-cured ...	The plants owing to stunted growth did not bear more leaves.
5th November 1909.	4th March 1910	Basal leaves primed; the rest cut whole.	10—12 leaves.	Ditto. ...	Ditto.
3rd to 7th November 1909.	21st January 1910.	Ditto ...	12—15 leaves.	(1) A small portion was cured by fire, but the heavy rainstorm of 30th March having damaged the curing room and flooded the furnace, the curing proved a failure. (2) The bulk of the crop was cured in the barn. The crop was cut before the hail storm and cured first in a temporary shed and then in the curing barn. This lot appears to have cured well. A considerable portion of the leaves has a yellow colour and may prove suitable for cigarette. (3) A small portion which was intended for fire-curing was badly damaged by rain and wind while in the field. It was cured in the sun.	
8th November 1909.	15th March 1910.	Ditto ...	12—15 leaves.	Partly cured in the barn and partly in the sun.	
8th November 1909.	15th March 1910.	Ditto ...	12—15 leaves.	Ditto.	
8th November 1909.	13th April 1910	Cut whole ...	8—10 leaves.	Ditto.	
8th November 1909.	13th April 1910	Ditto ...	8—10 leaves.	Ditto.	
9th November 1909.	15th March 1910.	Ditto ...	20—22 leaves.	Growth was very poor. Looked much like Cavalla. Cured wholly by fire. Its curing was not successful.	

Serial No.	Class of tobacco.	Variety.	Source of seed.	Area in acres.	Rotation.	Manure per acre.
1	2	3	4	5	6	7
9	American cigarette tobacco.	Stemmed Orinoco ...	Farm-grown seed of 1907-1908.	·02	Ditto ...	Ditto ...
	.....	Little Flemingen ...	Ditto ...	·10	Ditto ...	Ditto ...
10	Turkish tobacco.	Cavalla	Ditto ...	·02	Ditto ...	Ditto ...
	(a) Transplanted.	Sari	Ditto ...	·10	Ditto ...	Ditto ...
	.....	Scented leaf ...	Ditto ...	·10	Ditto ...	Ditto ...
	(b) Broad casted.	(1) Sari	Ditto ...	·05	Ditto ...	Nil.
	.....	(2) Scented leaf ...	Ditto ...	·05	Ditto ...	Ditto ...

Time of transplanting.	Date of commencement of harvest.	Mode of harvesting.	Number of leaves kept on a plant.	Mode of curing.	Remarks.
8	9	10	11	12	13
8th November 1909.	15th March 1910.	Basal leaves primed; the rest cut whole.	10—12 leaves.	The whole of it was fire-cured.	
6th November 1909.	8th February 1910.	Ditto ...	10—12 leaves.	Ditto.	
3rd November 1909.	12th January 1910.	Ditto ...	20—25 leaves.	Ditto.	
2nd November 1909.	30th December 1909.	Ditto ...	15—16 leaves.	Ditto.	
1st October to 3rd November 1909.	27th December 1909.	Ditto ...	20—25 leaves.	(1) Partly cured in the barn and partly by fire. Fire-curing was not successful.	
.....	15th January 1910.	Ditto ...	15—18 leaves.	Fire-cured.	
.....	3rd January 1910.	Ditto ...	25—20 leaves.	Ditto.	

The scheme of experiment was virtually the same as in previous years. At the instance of the Farm Superintendent a small area of Turkish tobacco was raised from broadcasted seed with the idea of reducing the cost of cultivation. Except the broadcasted tobacco which stood apart and occupied an area of only one-tenth of an acre, all the varieties were planted side by side in a portion of Block C measuring 2·26 acres. In spite of the absence of rain during the first three months of the season, the crop grew with great luxuriance except on a patch of poor soil, about a fifth of an acre, where the plants remained more or less stunted. This patch contained most of the minor varieties grown during the year. The bulk of the crop consisted of one acre of *Sumatra* and half an acre of *Bhengi*, both of which grew very well and gave satisfactory yields. Among the minor varieties which grew uniformly well and gave full yields were *Connecticut seed-leaf*, *Sari* and *Scented leaf*.

Tobacco sources of seed.

9. The tobacco crop of 1908-1909 having failed, no seed could be saved out of that crop. Most of the varieties grown last year were raised from seed saved two years ago, namely, in 1907-1908. Three new varieties were added during the year, namely, *Patuakhol* and *Hansgola* of which seed was obtained from Jalpaiguri and *Zimmer Spanish*, an American variety of which seed was received from Pusa.

The attempt made in previous years to raise pure self-fertilised seed by enclosing the flower heads in glass frames proved fairly successful. This line of work has not however been pursued for the past two years, but I propose to resume it in the next season. Mr. and Mrs. Howard, in their recently published memoir on the *Types of Nicotiana rustica* and *N. tabacum*, have drawn attention to the danger of natural inter-crossing of distinct types leading to the formation of new and undesirable forms. This danger is particularly great in an experimental farm where a large number of kinds are grown in close proximity to each other.

Tobacco—manuring.

10. Cowpea was grown on the land in the preceding rains. It grew remarkably well and was ploughed in about three months before the tobacco was planted. The green stuff got so well assimilated with the soil that not a vestige of leaf or stem was visible at the time the tobacco plants were put in. About a month before planting, a light dose of well rotted cowdung at the rate of 75 maunds to the acre was applied to the land.

11. The bulk of the crop was cured in the shade as in previous years. It consisted mostly of *Sumatra* and *Bhengi* tobacco. The curing barn was too small to accommodate all the tobacco and part of the shade-cured tobacco had therefore to be dried in the fermentation shed and in a temporary *kutcha* house which had been put up for storing *bhusa*. No arrangement existed in these two houses for regulating the humidity and temperature of the air. The cigarette tobaccos were flue-cured. These consisted principally of the Turkish varieties, *Little Flemingen* and a portion of the *Connecticut seed-leaf*. The last mentioned variety is regarded as a cigar tobacco, but we found that by flue-curing it could be made to acquire a brighter yellow colour than any other variety grown on the farm.

Tobacco—method of curing.

Flue-curing was tried for the first time in the year under report and on the whole with encouraging results. A description of the method of flue-curing is given in paragraph 12. There was no proper barn in the farm for this kind of curing. A corner of the fermentation shed was walled in and fitted up with a fire place and iron pipes for the purpose. The room was a very small one being only about 12′×8′ and 10 feet high, and just large enough to cure about 15 seers of tobacco at a time.

For want of time and space in the curing houses, we were obliged to dry a small portion of the crop in the sun. The weather at the time proved too wet to suit this method of curing, and the tobacco treated in this way turned bad.

The curing of tobacco with artificial heat is adopted for producing yellow leaf for the manufacture of cigarettes. This method of curing is in vogue in certain parts of the United States which make a speciality of producing yellow cigarette tobacco. As mentioned before, we used a small improvised room as a barn. The room was fitted with a furnace which was fed with fuel from outside. An iron pipe or flue, about 12 inches in diameter, led from the inner end of the furnace, and after traversing the whole length of the room turned back and passed out of the room at a point above the mouth of the furnace. The fuel used consisted mostly of dry *Jowar* stalks and bamboos. A small quantity of mango wood was also used. The tobacco plants were brought fresh from the field and arranged on thin bamboo sticks and these were

Description of flue-curing.

laid on a scaffolding of bamboos in the barn. The fire was started as soon as the barn had been filled in. The heat was gradually raised from the normal to about 180 F. The curing was carried on in four successive stages as follows :—

1st.—The yellowing of the leaf requiring 90° of heat and lasting for 24 to 30 hours.

2nd.—Fixing the colour of the leaf which takes place at temperatures between 100° F. and 120° F., and requires from 16 to 20 hours.

3rd.—The curing (complete drying) of the leaf requiring a temperature of 120° to 125° and lasting 10 to 12 hours.

4th.—The curing of the stalks and stems which require 9 or 10 hours and a temperature rising gradually from 125° F. to 180° F.

The fire was stopped as soon as the curing was finished, and the door and the ventilators were thrown open to cool the tobacco. If the weather happened to be dry, straw was spread on the floor of the room and moistened with water. The cooling process took 24 to 30 hours. After the tobacco had cooled down and become supple enough for safe handling, it was taken out of the barn and kept lightly heaped for a few days. This caused a slight degree of fermentation, and improved the colour of those leaves, which still retained a greenish tinge when taken out of the barn. Finally the tobacco was sorted into grades according to the size, colour and general appearance of the leaves.

Flue-curing of tobacco—results.

13. The regulation of heat during the curing process had to be varied according to the character of the tobacco and required the exercise of the greatest care and discrimination. The Farm Superintendent, Babu Jamini Kumar Biswas, had no previous experience of the flue-curing of tobacco. This method of curing was reported to be in successful operation on the State Tobacco Farm at Cooch Behar where it had been introduced a year ago. Jamini Babu visited Cooch Behar in January last to study the method, and I myself went there for the same purpose a month later. It was inevitable that mistakes should occur in the beginning. About one-half of the tobacco cured with artificial heat has turned out as well as we could expect, so far as the colour of the leaf is concerned.

One curing was spoiled by a heavy storm which blew down a wall of the curing room. In case of two other charges the temperature of the room could not be raised beyond 135° F; in consequence of a defect in the flue, with the result that, although the leaves cured to a bright yellow colour, too much sap was left in the butts causing them to turn mouldy in store.

Yield and cost of cultivation and curing.

14. The subjoined table shows the yield of each variety of tobacco as well as the cost of cultivation and curing in case of those varieties which grew well and gave substantial yields.

Yield of Tobacco, 1909-1910.

Serial No.	Name and variety of tobacco.	Area planted.	Method of curing.	Grade of Tobacco.	Actual outturn.	Outturn per acre.	Actual cost of cultivation and curing.	Cost of cultivation and curing per acre.	Cost of cultivation and curing per maund.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
					M. s. ch.	M. s. ch.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	*Exotic varieties.*—	Acre.								
	Sumatra ...	1·0	Barn-cured	(1) Wrappers and binders, large	2 8 0	.....	.....	.....	.....	
				(2) Ditto, medium ...	3 32 8	.....	.....	.....	.....	
				(3) Ditto, small ...	2 30 0	.....	.....	.....	.....	
				(4) Filler, large	1 7 8	.....	.....	.....	.....	
				(5) Ditto, medium ...	0 33 0	.....	.....	.....	.....	
				(6) Ditto, small	2 21 0	.....	.....	.....	.....	
			Sun-cured	(7) Black Hookka... ...	0 20 0	.....	.....	.....	.....	
				Total	13 22 0	.....	193 15 0	.....	14 5 0	
			Fire-cured	(8) Inferior sort-small fillers	0 15 0	.....	.....	.....	.....	A small portion did not grow well and a portion was also spoiled by high wind and hail storm.
				(9) Yellow	0 9 8	.....	.....	.....	.....	
				Total	0 24 8	.....	10 14 0	.....	17 9 0	
				Grand Total	14 6 8	14 6	204 13 0	204 13 0	.....	

2	Havana ...	·1	Barn and fire-cured.	(1) Filler large	0 13 8	.....	.....	.....	.....	
				(2) „ small	0 1 8	.....	.....	.....	.....	A large portion was spoiled by high wind and hail storm and the growth was also poor.
			Sun-cured	(3) Hookka tobacco ...	0 16 0	.....	.....	.....	.....	
				Total ...	0 30 0	7 20 0	.....	.....	.....	
3	Connecticut seed leaf...	·1	Fire-cured	(1) Good yellow of all lengths	0 27 8	.....	.....	.....	.....	
				(2) Dark or otherwise inferior	0 4 0	.....	.....	.....	.....	
				Total ...	0 31 8	.....	17 10 0	.....	22 6 0	
			Barn-cured	(1) Filler, big size ...	0 18 0	.....	.....	.....	.....	
				(2) „ medium ...	0	.....	.....	.....	.....	
				(3) „ small	0 9 0	.....	.....	.....	.....	
				Total ...	0 33 0	.....	12 0 6	.....	15 4 3	The crop grew well and uniformly in the whole plot.
				Grand Total ...	1 4 8	16 5 0	30 3 6	302 3 0	.....	
4	Pennsylvania ...	·02	Ditto ...	Filler I sort	0 7 8	9 15 0	.....	.....	.....	A portion of the crop remained stunted.
5	Zimmer Shamish ...	·1	Ditto ...	„ „ medium	0 8 8	.....	.....	.....	.....	
				... ...	0 11 8	.....	.....	.....	...	Growth was very poor.
				Total ...	0 20 0	5 0 0	.....	.....	...	

*Yield of Tobacco, 1909-1910—continued.

Serial No.	Name and variety of tobacco.	Area planted.	Method of curing.	Grade of Tobacco.	Actual outturn.	Outturn per acre.	Actual cost of cultivation and curing.	Cost of cultivation and curing per acre.	Cost of cultivation and curing per maund.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
					M. s. ch.	M. s. ch.	R. a. p.	R. a. p.	R. a. p.	
62	Local Rangpur varieties—									
	(1) Bhengi ...	·5	(1) Fire-cured.	Inferior sort	0 25 0	.....	3 0 0	.....	12 12 9	
			(2) Barn-cured.	(1) Yellow, big size ...	4 15 0	.....	.....	.....	.....	
				(2) Yellow, small	1 20 0	.....	.....	.....	.....	
				(3) Dark coloured, big size ...	0 30 0	.....	.....	.....	.....	
				(4) Dark coloured, small ...	2 13 0	.....	.....	.....	.....	A small portion was spoiled by hail storm.
				Total	8 38 0	.....	102 15 3	.....	11 8 0	
				Grand Total ...	9 23 0	19 6 0	110 15 3	221 14 6	.....	
	(2) Sindur khaira ...	·02	Barn-cured	(1) 1 Sort	0 2 0	.....	.....	.....	.....	
			Sun-cured	(2) 1 Sort	0 3 0	.....	.....	.....	.....	
				Total	0 12 8	15 25 0	.....	.....	.....	A portion showed poor growth.

	(3) Naokhol ...	·02	Barn-cured	(1) 1 Sort	0 10 0	.....	.....	.....	.....	
			Sun-cured	(2) 1 Sort	0 3 8	.....	.....	.....	.....	Ditto ditto.
				Total	0 13 8	16 55 0	.....	.....	.....	
7	*Jalpaiguri* varieties—									
	(1) Patuakhol ...	·02	.....	1 Sort	0 5 0	6 10 0	.....	.....	.....	Very poor and stunted growth.
	(2) Hasgola ...	·02	.....	1 sort	0 4 0	5 0 0	.....	.....	.....	Ditto ditto.
				Total	0 9 0	11 10 0	.....	.....	.....	
8	Chittagong variety—									
	Matamuri ...	·02	.....	1 sort	0 1 8	1 35 0	.....	.....	.....	Ditto ditto.
9	American cigarette tobacco—									
	(1) Stemmed Orinoco	·02	Fire-cured	(1) Good yellow ...	0 3 8	.....	.....	.....	.....	A portion was poor and stunted.
				(2) Dark or otherwise inferior	0 2 4	.....	.....	.....	.....	
				Total ...	0 5 12	.....	.....	.....	.....	

Field of Tobacco, 1909-1910—continued.

Serial No.	Name and variety of tobacco.	Area planted.	Method of curing.	Grade of Tobacco.	Actual outturn.	Outturn per acre.	Actual cost of cultivation and curing.	Actual cost of cultivation and curing per acre.	Cost of cultivation and curing per maund.	Remarks.
1	2	3	4	5	6	7	8	9	10	12
					M. s. ch.	M. s. ch.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
			Barn-cured	(3) 1 Sort	0 3 12	.....	.....	.....	.....	
				Total ...	0 9 8	11 35 0	.....	.....	.....	
	(2) Little Flaimangen		Fire-cured	(1) Bright yellow ...	0 15 0	.....	.....	.....	.....	
				(2) Medium yellow ...	0 9 8	.....	.....	.....	.....	
				(3) Dark or otherwise inferior	0 19 4	.....	.....	.....	.....	A portion was poor and stunted.
				(4) Bottom leaves ...	0 6 0	.....	.....	.....	.....	
				Total ...	1 19 12	12 17 8	21 14 0	218 12 0	17 9 6	

10	Turkish tobacco—										
	(1) Cavalla ...	·02	Fire-cured	(1) Good yellow ...	0	5	0	.....	.....	.....	.....
				(2) Medium-yellow ...	0	1	0	.....	.....	.....	.....
				(3) Inferior sort ...	0	1	10	.....	.....	.....	.....
				Total ...	0	8	10	8 11 4	6 12 0		40 12 0
10	(2) Sari	·10	Do. ...	(1) Good yellow	0	14	4	...	...	...	...
				(2) Medium yellow ...	0	5	8	...	...	...	...
				(3) Inferior sort	0	29	8	...	...	...	...
				Total ...	1	9	4	12 12 0	30 5 9	363 9 6	29 5 3
	(3) Scented leaf ...	·1	Do. ...	1 sort fire-cured inferior leaves.	0	37	0	9 10 0	35 11 9	3 7 3 0	39 5 3
	(4) Sari, broad casted	·05	Do. ...	(1) Good yellow ...	0	6	0		...	...	...
				(2) Medium ...	0	10	0	...	...	...	...
				(3) Inferior sort	0	2	0	...	...	...	...
				Total ...	0	18	0	9 0 0	10 2 6	286 2 0	22 9 6

The crop was partly injured by shade from bamboo clumps in the neighbourhood of the area. But for this a still better yield might have been obtained.

Yield of Tobacco, 1909-1910.—concluded.

Serial No.	Name and variety of tobacco.	Area planted.	Method of curing.	Grade of Tobacco.	Actual outturn.	Outturn per acre.	Actual cost of cultivation and curing.	Cost of cultivation and curing per acre.	Cost of cultivation and curing per maund.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
					M. s. ch.	M. s. ch.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
	(5) Scented leaf, broadcasted.	·05	Fire-cured	(1) Good yellow	0 2 12	...	...	...	...	Greatly injured by shade from bamboos. The crop practically failed in consequence.
				(2) Medium yellow ...	0 0 4	...	...	...	...	
				(3) Inferior sort	0 2 8	...	...	...	...	
				Total ...	0 5 8	2 30 0	...	...	...	

The produce of each variety has been sorted into grades according to size, colour, texture, etc., of the leaves. From column 7 of the table, the yields will be seen to have been very satisfactory except, as stated before, in case of some minor varieties which occupied small areas and happened to be planted in a portion of the field which proved barren.

Column 10 of the table shows for the more important lots the actual cost of production per maund which includes charges for cultivation as well as for curing. Every item of cost has been taken into account except the following:— rent and cost of seed and cowdung, the two last being produced on the farm, and in case of the flue-cured tobacco, the cost of the fuel. The last item, if added, is expected to enhance the cost of production by Rs. 4 or 5 per maund of cured leaf. When we have obtained valuation of the principal grades, we shall be able to judge whether it will pay to grow any of the varieties, of which the cost of production has been given. It will be of course remembered that the cost of cultivation would be considerably less on a cultivator's holding than on a Government Farm where everything has to be paid for and labour is more costly and less efficient. With regard to the cigar tobaccos, past experience does not give much hope for a good valuation, but I expect that at least in the case of the principal variety grown last year, *viz.*, *Sumatra*, the cost of production will be more than covered by the value of the produce.

With regard to the fire-cured cigarette tobacco, we may count upon obtaining a price of Rs. 30 per maund. This rate has been paid by the Rangpur Tobacco Company for a large quantity of fire-cured tobacco produced in the Cooch Behar Farm last season. If this price can be always realised, I think it will pay well to grow cigarette tobacco and cure it by fire.

The experiment in growing Turkish tobacco from broadcasted seed has given an encouraging result. The cost of cultivation (*i.e.*, excluding cost of harvesting and curing) came to Rs. 35-7-6 per acre as against Rs. 100-10-0 in case of the same variety of tobacco raised from transplanted seedlings. The broadcasted and transplanted plots were not situated side by side; no strict comparison, as regards yield, is therefore possible. For rough comparison, however, I give the yields per acre below:—

Broadcasted ..... 9 maunds of cured leaf.

Transplanted ..... 12 maunds 12 seers 8 chataks of cured leaf.

Thus each maund of cured leaf cost a little less than Rs. 4 to grow from broadcasted seed, while the cost in the case of the transplanted crop was a little over Rs. 8. Broadcasting seems, therefore, to possess an advantage over transplanting in case of thin small-leaved tobaccos like the Turkish kinds which can be grown thickly in the field and require little or no attention in the way of topping and suckering. This experiment was made last year only for the first time and that too on a very small area, and it will be too premature to draw any definite conclusions.

Samples of tobacco out of the crop of 1909-1910 submitted for valuation.

15. Eight samples of cigar and cigarette tobacco out of the last crop have been sent to London for valuation. These have been consigned to the care of Mr. S. G. Hart, I.C.S., who is now at home on leave. Samples of cigar leaf have been submitted for report to several firms in Madras and of cigarette tobacco to the Director of the Peninsular Tobacco Company at Monghyr. It will be some time before these valuations are received.

Valuation of samples from the crop of 1908-1909.

16. Twenty-seven samples from the crop of 1908-1909 representing various grades of cigar and cigarette tobacco were submitted last year to the Director of the Peninsular Tobacco Company who was good enough to examine and report on them. He considered that seven of these samples (5 of *Sumatra* and 2 of Connecticut seed leaf, all cured in the shade) were suitable for cigarette making and of a fair colour. The colour was, however, not so bright as it could be, and the leaf had a slight earthy odour which might with advantage be eliminated. The remaining 20 samples, mostly cured in the sun, were considered unsuitable for cigarette making, the colour being either too green or too dark brown for the purpose.

Two samples of *Sumatra* tobacco from the 1908-1909 crop were sent during the year to Mr. S. G. Hart, who is now in England. He submitted these for valuation to Messrs. Edgar P. Bidwell and Company, of Bush Lane House, Cannon Street, London, who reported that "the leaf is fairly good and would sell in this market, but that the coarseness and thickness of the stalk absolutely condemns the parcel as useless." No quotation was received.

Report on samples from the crop of 1907-1908.

17. A report was received during the year on three samples of tobacco from the crop of 1907-1908 (1 *Sumatra*, 1 Connecticut seed leaf, 1 Turkish) sent to the Imperial Institute for valuation by experts in London. The report which contains the result of an elaborate examination of the tobacco is reproduced in the Appendix.

The sample of *Sumatra Wrapper* leaf was considered to be "of considerable commercial value. The burning and the flavour of the tobacco were both fairly satisfactory for wrapper tobacco intended for cigars of medium quality." The chief defects were the prominent white veins and a rather large proportion of sulphuric anhydride which was believed to be the cause of the black colour of the ash left on smoking. The experts thought that the first-mentioned defect arose from great dryness of the atmosphere and might be remedied by keeping the air of the room moist by artificial means. The *Connecticut* filler tobacco was pronounced to be of a coarse character, due, it was believed, to the soil on which it was grown being too rich and to the few leaves having been left on the plants. This sample as well as the *Sumatra* were grown on the old Rangpur Farm and not at Burirhat, and it is very possible that the coarseness of the *Connecticut* seed-leaf was due, as suspected by the London Experts, to the over-richness of the soil, the soil of the Rangpur Farm being extraodinarily rich in all the chief ingredients of plant food except lime. The Turkish tobacco, which was the only one out of the three samples that was grown at Burirhat, was reported to have lost all trace of the Turkish tobacco character. We have been advised, however, to continue the cultivation of this tobacco and to use fresh seed from Turkey. Some new seed has accordingly been imported through the kind assistance of the British Consul-General at Constantinople and will be used in the ensuing season.

Oats.

18. This crop was grown on 12·1 acres in Block E. Out of this area local oats occupied 6·1 acres and Hissar oats 6 acres. The land had been green manured with cowpea in the preceding rains, and received no other manure. In spite of the dryness of the season, the crop grew with luxuriance. It failed, however, to produce an abundance of grain, owing, it is believed, to the extreme poverty of the soil in respect of lime. The weather in May proved very wet and interfered seriously with the

threshing of the crop. With the utmost endeavour, only a part of the grain could be threshed out. A considerable portion of it remained in the straw which too could not be reduced to chaff. In all 62½ mds. of grain was obtained. The grain as well as the half-threshed straw are being fed to the farm cattle who have been found to thrive well on this feed.

A mixed crop of oats and peas was grown as fodder on 3·44 acres in Block C. It grew very well and gave a yield of 721 mds. of fodder, mostly cut in the green state.

Mustard.

19. In Block A, Raipur mustard grown on 1·66 acres and local mustard on 3·34 acres. Cowpea had been grown in the rains and ploughed in. It grew well on every part of the Block. But mustard failed over the greater part of the area, apparently for want of moisture (see paragraph 3). On a small portion of the area, the Raipur variety grew tolerably well, but produced, very little seed.

Potato.

20. Two varieties, namely, *Silbilati* (local) and *Darjeeling* were grown on one acre of land in Block C, each occupying half the area. In addition to green manuring with cowpea during the rains, the land received a dressing of 150 mds. of cowdung, shortly before the seed was planted. No irrigation was used. On portions of the field, the soil dried up quickly, and the growth of the crop was more or less stunted. The yield was 32 mds. from the local and 46 mds. 15 seers from the *Darjeeling* variety. For purpose of comparison, the areas on which the crop grew well, were measured and the yields from these areas were separately noted.

These were as follows :—

Local variety—17 mds. 10 seers from an area of 144 × 47 feet, equivalent to a yield of about 110 mds. per acre.

Darjeeling variety—23 mds. 15 seers from an area of 144 × 51 feet, equivalent to a yield of 137½ mds. per acre.

A large body of cultivators came in at the invitation of the Farm Superintendent to witness the harvest and compare the yields of the two varieties. They seemed to be struck with the large size and attractive appearance of the *Dārjeeling* potatoes, as compared with those of the local varieties. Six cultivators of the neighbourhood have purchased 5¼ mds. of these potatoes from the farm for sowing next season.

In point of freedom from disease and keeping quality, the *Darjeeling* variety compares unfavourably with the *Silbilati*. The latter was free from the least trace of disease, while about 25 per cent. of the *Darjeeling* tubers on being cut open were found affected with brown strains in the flesh. Experience has shown that while hill potatoes like Darjeeling and Nainital are superior in yield as well as in taste to any local varieties grown in the plains, they keep very badly through the rains, and they speedily deteriorate in the plains, unless fresh seed is imported annually from the hills.

Cowpea.

21. Cowpea was grown for the purpose of green manuring on 13 acres in Blocks A and C. The crop grew extraordinarily well, even on the most barren portions of the area. It was ploughed into the soil in August and proved an excellent manure for the tobacco crop which followed. The incorporation in the soil of a large mass of organic matter helped it at the same time to retain moisture during the cold weather, and although no rain fell from the end of October to the beginning of February, the soil never seemed to lack for moisture, except in those parts of the blocks in which the underlying sand lies too near the surface, and the top soil is too thin and sandy to retain much moisture at any time. The soil being generally sandy in this part of the country, the tobacco crop is always given two or more waterings in the latter part of the season when the plants need a large quantity of water to replenish the loss of moisture. The crop on the farm was found to thrive luxuriantly without any irrigation whatever, and many of those who visited the farm when the tobacco was in the field were quick enough to see the useful effect of the green manure on the fertility and water-retaining property of the soil. Several raiyats have since applied to the farm for cowpea seed and been supplied with a few seers each, free of charge. Four maunds and 27 seers of cowpea seed have been supplied in this way to some 20 raiyats in the neighbourhood. I have questioned some of these men and found them to be well convinced of the utility of cowpea as green manure.

Dhanche.

22. This crop was grown as green manure on 12·82 acres of land in Block E. It grew well but somewhat unevenly, and part of it was attacked by two species of caterpillars (*Prodenia littoralis*

and *Terias hecabe*) which ate up the leaves. The crop was ploughed in in August and the land was subsequently grown with oats.

Jowar.

23. This crop was grown for fodder on 3·70 acres in Block B. It grew with extraordinary luxuriance and proved exceedingly useful for feeding the farm cattle. As much fodder was cut daily as was necessary for the day, only about half of the area could be utilised in this way; it yielded 981½ maunds of green stuff, that is, about 500 maunds to the acre. The remaining half became too coarse and dry, and there being no want of fodder on the farm, it was cut down and utilised as fuel in the flue-curing of tobacco.

Though the neighbouring cultivators have seen this fodder crop grown and used in the farm, they have not as yet evinced any desire for growing it on their own holdings. Indeed they have yet to be convinced of the necessity of cultivating any fodder crop at all, beyond the straw of the crops which they ordinarily grow.

Ground-nut.

24. Ground-nut was grown on a quarter of an acre. It is new to the district and was grown for the first time on this farm. It grew very well at first, but the heavy rains in June spoiled it by inducing the growth of a fungoid disease, very possibly the same as the *ticca* disease of Western India. It was found that plants which came up later in the season (August and September) grew well and was free from this disease. It is proposed therefore to sow the crop this year in August and September in order to see whether late planting will help it to escape the disease.

Aus paddy and Matikalai.

25. A variety of fine *Aus* rice called *Sonamili* was grown on 10·67 acres in Block D. The crop grew well and yielded 138 maunds of paddy, *i.e.*, at the rate of about 13 maunds to the acre. The yield of grain was not quite so good as the appearance of the crop led us to expect. The crop was injured to some extent by a species of stem-borer which fed inside the stalks of the green ears; and later on when grain was formed, it was attacked by a species of bug. The latter was kept in check by a kind of ladybird which appeared in large numbers and lived by preying upon the bugs. An attempt was made to sweep off the bugs with a net, but it was found impracticable to drag a net over the paddy owing to the liability of the grain to shed.

The *aus* crop was followed by mati-kalai. It grew well and yielded 43¼ maunds of grain which was used for feeding the cattle on the farm. The straw also provided an excellent fodder.

Ceylon and Bangalore papayas.

26. Some papaya trees of these two varieties were planted in the previous year. Last year several of the trees bore fruit for the first time. Some of the fruits were of splendid size. The largest specimen of Ceylon papaya measured 13 inches in length and 17½ inches in girth and turned the scale at 3¼ seers, and the largest Bangalore fruit measured 8 inches and 22 inches, respectively, and weighed 2 seers and 3 chataks. The trees were damaged by the cyclone in October and have lost vigour since. They have been recently manured with a heavy dressing of cowdung and bone meal and are now putting on a fresh growth. I do not feel quite hopeful of the success of these fruits in our climate. Many of the fruits are ill-shaped and remain small. Our winter is perhaps too cold to suit these varieties well.

Supply of seeds.

27. The following seeds and manures were distributed from the farm during the year.—

Tobacco seed	...	...	16 ounces.
Oats	...	...	1 md. 25 seers.
Jowar	...	...	1 seer.
Dhanche	...	...	18½ seers.
Cowpea	...	...	4 mds. 32 seers.
Raipur and local mustard		...	2 seers.
Bone meal	...	...	1¼ md.
Darjeeling potatoes	...	...	5 mds. 10 seers.

As already mentioned (paragraph 6) a large quantity of tobacco seedlings, estimated to suffice for planting 100 *bighas* (33 acres) of land, was distributed free among neighbouring raiyats who had lost their own seedlings through excessive rain in September and October.

Improved implements.

28. Among the new applicances used on the farm during the year, particular mention should be made of the Planet Jr. Handhoe, the Hindustan plough, and Hardy's winnower. The Farm Superintendent's report on these is reproduced below. I concur in the observations he has made on the utility and efficiency of these appliances.

"*Planet Jr. Handhoe, cost Rs.* 26-8.—This implement was largely used during the year in the interculture of tobacco, ground-nut and Euchlœna, and in the earthing up of potatoes. For tobacco and potatoes, the hoe was fitted up with a ploughshare, and for the other crops with a set of three tynes which gave a light grubbing to the soil.

"The ryots use a kind of hand plough called *hat nangli* which is nothing but an old worn-out plough with a narrow share attached to it. This is drawn by a man walking slowly backwards between two lines of tobacco. Work therefore is naturally very slow. The Planet Jr. Handhoe fitted with a single soil investing ploughshare was found to do this work better and more quickly and perhaps it did 3 to 4 times as much work as the *hat nangli*. I could confidently recommend this to the tobacco cultivators here but for the cost of this implement and the difficulty of obtaining repairs. I may mention here that though the Planet Jr. Hoe has been used for more than a year in the farm, it has so far required no repairs.

"*Hindustan plough, price Rs.* 14.—This was obtained 4 years age for the Rangpur Farm and has been used there as well as in the Burirhat Farm for ordinary ploughing. The share has been changed twice (once with a share made locally) and requires renewal again. In August 1908 Mr. Birt tested the plough against the style of country plough used on the farm, which latter is larger in size and more effective than the small ploughs used by the local cultivators, and he found that the country plough used on the farm did much better work both in breaking up new land and in cultivating land already broken up. At the time of this test the original ploughshare having got worn out had been replaced by a share locally made. I have since found that with a new well-made share the Hindustan plough works well and is decidedly more useful than the country plough for first ploughing as well as for breaking new land, *i.e.*, in those cases in which the soil is benefited by inversion.

"*Hardy's Winnower, cost Rs.* 110.—This was recently purchased by the Agricultural Department from the managing committee of the Dhubri Exhibition. Pending its removal to the Dacca Farm it was sent to this farm for winnowing oats. The machine has not been thoroughly tested as yet, but so far as I have been able to judge in the few days it has been worked on the farm, it does not appear to be so

efficient as it claims to be. The machine has a flimsy structure and I do not think it will be able to stand much hard work. Considering its cost I do not think it will be liked by raiyats in this province. I intend however to try the machine for winnowing *aus paddy* with which it might do better work than with oats which is the only grain so far tried."

Receipts and Expenditure.

29. The total receipts of the farm during the year ending 30th June 1910 amounted to Rs. 471-15-0, and the total expenditure to Rs. 10,812-9-5, out of which Rs. 5,513-3-1 represented capital charges for the construction of buildings and wirefencing, and Rs. 2,535-5-5 the cost of the establishment including house and travelling allowances of the Farm Superintendent.

Establishment.

30. The establishment consists of a Farm Superintendent on Rs. 100-10-200, a Fieldman-clerk on Rs. 25—1-8—40 and a Durwan on Rs. 8. The present Fieldman-clerk joined his post on the 22nd July 1909.

Inspection.

31. The farm was inspected twice during the year by the Officiating Director of Agriculture, once by Mr. A. G. Birt who officiated for me during my absence on leave, and nine times by myself between October and the end of the year. Mr. A. A. Meggitt, Agricultural Chemist, paid a visit to the farm in May last. Mr. F. J. Monahan, I.C.S., Commissioner of the Division, visited the farm once. Mr. J. Vas, I.C.S., late Collector of the district, paid several visits to the farm, and the present Collector, Mr. J. McSwiney, I.C.S., visited the place once during the year. The Maharaj Kumar of Tajhat came to the farm once with Mr. Vas and expressed his desire to promote the cultivation of cigarette tobacco in his estate.

The farm was visited by a large number of raiyats from the surrounding country. Being situated close to a bi-weekly market, it is easy of access to the raiyats of the neighbourhood.

Conclusion.

32. In concluding this report I desire to record my good opinion of the work done by the Farm Superintendent, Babu Jamini Kumar Biswas, during the year. He is full of enthusiasm for his work. He has acquired by dint of observation and expe-

rience in the field an exceptional insight into all matters affecting the cultivation of the tobacco crop. His general work as Superintendent of the farm has also been very good. The neighbouring cultivators used at first to look upon the farm with great suspicion, but Jamini Babu appears to have succeeded in winning their good will and I have found that the farm is now freely resorted to by cultivators whenever there is any interesting experiment in progress. I have already mentioned that a number of raiyats have applied to the farm and been supplied with seeds for trial on their own holdings. The Farm Superintendent deserves credit for this happy change in the attitude of the raiyats.

SHILLONG,
The 25th July 1910.

B. C. BASU,
Deputy Director of Agriculture,
Eastern Bengal and Assam.

APPENDIX.

Report received from the India Trade Enquiry Office, Imperial Institute, London, on the result of the examination of tobacco from Rangpur, India.

"Sumatra, outside wrapper." About ¾lb.

The sample consisted of a single hand of large, uniformly coloured medium brown leaves of good soft elastic texture. The midribs of veins were prominent and bright coloured. The average measurements of the leaves were as follows:—length 20 inches, width 6½ inches, thickness of midrib at base ⅕th inch.

The tobacco burnt fairly well, and left a dark ash which however was somewhat lighter than the ash of the other samples dealt with in this report. The aroma was pungent.

	Per cent.
Moisture	10·0
Total nitrogen	2·4
Nicotine	2·1
Ash	18·8

The ash contains—

	Per cent.
Potassium oxide	20·2
Sodium oxide	2·1
Lime	19·7
Magnesia	5·4
Sulphuric anhydride	4·9
Chlorine	1·6

The tobacco was submitted to experts who reported that it should be of considerable commercial value, the chief fault being the prominent white veins in many of the leaves. One firm consulted pointed out that the midribs were unduly large in proportion to the width of the leaves. The burning and flavour of the tobacco were both fairly satisfactory for wrapper tobacco intended for cigars of medium quality.

"Connecticut sead leaf for inside wrapper and filler," about ¾lb.

The sample consisted of a single hand of somewhat coarse tobacco, varying in colour from yellowish-brown to deep brown. The midrib and lateral veins were rather promi-

nent and white. The average measurements of the leaves were as follows :—length 21 inches, width 7 inches, thickness of midrib at base $\frac{3}{16}$th of an inch.

The tobacco burnt readily and held fire well, but gave off a rather pungent smoke and left a black ash.

	Per cent.
Moisture	10·2
Total nitrogen	2·1
Nicotine	3·3
Ash	22·8
The ash contains :—	
Potassium oxide	20·3
Sodium oxide	1·9
Lime	20·2
Magnesia	5·5
Sulphuric anhydride	6·7
Chlorine	*Nil.*

The tobacco was submitted to experts who reported that it was not superior to the various Indian tobaccos on the market, but that it was worth improving with a view to obtaining a product of greater bulk for a given weight while retaining the characteristic Indian flavour.

"Turkish Tobacco, scented leaf for cigarettes" about 6 oz.

The sample consisted of several bundles of dull brown leaves with a sort of elastic texture. The leaves did not possess the characteristic aroma or appearance of Turkish tobacco. The average measurements of the leaves were as follows :—length 9 inches, width 5 inches, thickness of midrib at base $\frac{1}{16}$th of an inch.

The tobacco held fire well but left a dark grey ash edged with black. The aroma of the smoke recalled that of a mild cigar leaf rather than that of Turkish tobacco.

	Per cent.
Moisture	11·2
Total nitrogen	3·0
Nicotine	1·0
Ash	18·8

The ash contains :—

	Per cent.
Potassium oxide	24· 0
Sodium oxide	0· 6
Lime	21· 7
Magnesia	6· 5
Sulphuric anhydride	2· 0
Chlorine	0· 6

This tobacco has been improperly grown and cured and in its present state, would not find a market as a Turkish tobacco.

General conclusions.—In composition these tobaccos are all satisfactory ; the nicotine is low as is also the total nitrogen and the amount of moisture is sufficient to keep the tobacco in good condition for export purposes. The ash in all three cases is rich in potash and consequently the tobacco burns well. The two cigar tobaccos yield ash which contains rather a large proportion of sulphuric anhydride, and it is probable that this is to some extent the cause of the black colour of the ash left by these tobaccoes. The comparatively large amount of sulphuric anhydride may be due to the application of potassium sulphate as a manure.* Potash is best applied for manurial purposes for tobacco in the form of the carbonate and should be applied several months before the plants are planted out. If sulphates have not been applied as manures in this instance, the sulphuric anhydride must have been derived from the soil itself and in that case the application of lime to the soil may prevent the absorption of sulphates by the plant to some extent. The other principal fault of the wrapper tobacco is the presence in some of the leaves of prominent "white veins." This is not a serious fault in tobacco except where the leaves are intended for use as wrappers for cigars. The white veins are generally believed to be due to too great dryness of the atmosphere and their formation may often be prevented by sprinkling water on the floor of the shed in which the tobacco is undergoing fermentation.

The filler tobacco, as pointed out by one of the experts, has the coarse character of the leaves common to most Indian tobaccos. There are two ways in which this might perhaps be remedied. (1) The plants might be topped somewhat higher than usual in order to ripen a large number of leaves. This procedure should have the effect of

* As a matter of fact no such manure was used, but the soil is known to be very poor in lime.—B. C. B.

giving a thinner type of leaf. (2) In many tobacco growing countries it is the practice to grow maize on rich land for several years before planting tobacco, as this partial exhaustion of the soil is found to prevent the growth of coarse, rank, large-leaved tobacco. Experiments in these two directions might be tried at Rangpur with a view to the improvement of the filler leaf.

The application of nitrogenous manures should also be avoided, except where they are necessary, as such manures applied in excess are liable to cause a rank growth in tobacco.

In spite of the defects noted above, which may probably be remedied by the expedients suggested, both the wrapper and the filler tobaccos must be regarded as of very promising quality, and if further improved in the directions indicated should be suitable for sale in this country at fairly good prices.

The Turkish tobacco need not be seriously discussed as it has been grown and cured in the wrong way and has lost all trace of the Turkish tobacco character. Experiments with this tobacco should however be continued. A good account of the methods which should be followed in growing and preparing Turkish tobacco is published in the Agricultural Journal of the Cape of Good Hope, Volume 34 (1909), page 377, to which reference might with advantage be made.

There is also special information available at the Imperial Institute with reference to the Turkish tobacco industry, and it is suggested that further enquiries should be made in reference to special points, as the trials progress. It is of the first importance that fresh selected Turkish seed should be used for planting.

ANNUAL REPORT OF THE RAJSHAHI AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1910.

Introduction.

The Farm which has been in existence since 1901 was handed over to this province at the time of the Partition of Bengal. It is situated just outside the town of Rampur-Boalia. Its total area is 63 acres, of which about 50 acres is under cultivation. About half of the area is lowland suitable for the growth of winter rice, while the remainder is high land suitable for the ordinary dry crops of the district. The soil of the lowland is stiff, while that of the high land varies from sandy loam to loam. Analysis has shewn the soil to be rich in lime, but somewhat deficient in phosphates and potash.

The lowlands are liable to disastrous floods from the Ganges and to water-logging for want of an outlet to carry off the rain water. These and other causes combined to render almost every experiment made in the year under report a failure.

Season.

2. There was a long drought in early spring which seriously interfered with the germination of sugarcane. In August there were heavy floods which destroyed the winter rice and groundnut crops and interfered with the preparation of the land for the *rabi* crops.

Programme of experiments.

3. The programme of experiments for the year and the results obtained are briefly noted in the following paragraphs.

Winter rice.

4. The winter rice experiments were :—

(*a*) *Trials of manures.*—One with bonemeal, soluble nitrogenous manures, cotton seed and fish manure; another to contrast green manuring against cowdung;

(*b*) Planting and Spacing experiments;

(*c*) Variety tests with several of the best local varieties.

Experiments (*a*) and (*b*) were intended to duplicate the manurial trials made on the Dacca Farm.

None of these experiments could be carried to completion owing to the crops having been destroyed by floods.

Jute.

5. As in the previous year, the jute experiments were made under the direction of Mr. R. S. Finlow, the Fibre Expert. There were two experiments :—

1. Manurial.
2. Rotation.

The first of these was made in duplicate in six plots, each $\frac{1}{80}$th of an acre, and intended to determine the effect of the manurial residue of the manures applied to those plots in the previous season (1908). All the plots were treated alike during the year and manured with 4 maunds of castor cake per acre. The yields were as follows :—

Number of plot.	Manure applied in 1908 per acre.	Manure applied in 1909 per acre.	Yield of Fibre per plot.	Yield of Fibre per acre.
1	2	3	4	5
			Mds. s. ch.	Mds. s. ch.
120A	Cowdung 21 mds. 16 srs. giving 30 lbs. of nitrogen.	Castor cake 4 mds.	1 35 5	9 16 9
120B	Castor cake 5½ mds. giving 30 lbs. of nitrogen.	Ditto ...	1 16 10	7 3 2
120C	Nil	Ditto ...	1 29 2	8 25 10
120D	Same as 120A ...	Ditto ...	1 37 8	9 27 8
120E	Same as 120B ...	Ditto ...	1 38 1	9 30 5
120F	Nil	Ditto ...	1 23 0	7 35 0

None of the plots gave a satisfactory yield. The crops did not do well enough to give reliable results. In the first series, the results were anomalous, the plot (120C), which received no manure in 1908, having produced a larger quantity of fibre than the one (120B), which received 5½ maunds of castor cake. The results from the second series (120D, 120E and 120F) were more in accordance with ordinary expectations, the two plots which were manured with cow dung and castor cake respectively in 1908 having given

a sensible increase over the plot which received no manure in that year.

The second experiment with jute was designed to contrast the following two systems of rotation :—

	I.	II.
Bhadoi, 1908 ...	Jute ...	Jute.
Rabi, 1908-1909 ...	Pulse ...	Potatoes.
Bhadoi, 1909 ...	Jute ...	Jute.
Rabi, 1909-1910 ...	Pulse ...	Pulse.

In No. I rotation none of the crops were manured, while in No. II the potato crop alone was manured at the rate of 150 maunds of cowdung per acre. The experiment has been in progress since the *bhadoi* season of 1908 and is in duplicate.

In 1908-1909 the average yield of fibre per acre from the two series was :—

	Mds. srs.
In rotation No. I	8 35
„ „ No. II	8 30

that is to say, almost equal, shewing that the contrasted plots were of about equal quality. The *rabi* crops which followed —pulse and potatoes—were almost complete failures in consequence of drought.

In the year under report (1909-1910),! the yields per acre were as follows :—

Rotation.	Jute Fibre.	Pea (pulse).	
		Grain.	Straw.
1	2	3	4
	Mds. srs.	Mds. srs.	Mds. srs.
No. I	9 3	9 7	9 11
No. II	8 10	10 26	14 15

The only difference in treatment between the two systems of rotation consisted in the fact that in Rotation No. II the land received an application of 150 maunds of cowdung

per acre in the *rabi* season of 1908-1909. The *bhadoi* crops of 1908-1909 were the same for all the plots (namely, jute), and the *rabi* crops of that year, though different in the two rotations (namely, pulse in I and potatoes in II), were almost complete failures as stated before. All the plots were alike in other respects. One would naturally expect in these circumstances that Rotation II which had the advantage of receiving 150 maunds of cowdung per acre would yield a larger outturn of jute in 1909 than Rotation I which never received any manure. But the result was just the opposite. The *rabi* crop, however, gave a larger yield in Rotation II than in Rotation I. It is also to be noted that the proportion of straw to grain was much greater in II than in I.

Sugarcane.

6. The following varieties were planted on $\frac{1}{5}$ acre plots for comparison :—Local Khagri, Samsara (new from Burdwan), Samsara (Farm sets), Dacca Ganderi, and Vandamukhi (from Rangpur). Owing to the long drought in the spring, the sets did not germinate well; the crops grew unevenly and were subsequently damaged by wild pigs and jackals. The produce was not considered to be worth weighing separately. The experiment was, therefore, a failure.

Potatoes.

7. Three experiments were tried, *viz*, :—

(1) Small sets *versus* medium sets,

(2) Darjeeling variety *versus* Nainital variety, and

(3) Hills seed *versus* plains seed (Darjeeling variety).

The experiments were complete failures. The first consignment of seed potatoes from Calcutta was wrecked in the cyclone which happened in October, and the second lot of seed arrived late in the season and failed altogether.

Oats.

8. Hissar oats was tried against the local variety. The experiment was made in duplicate in 4 plots, each $\frac{5}{10}$ths of an acre. The average yields per acre were as follows:—

	Grain Mds. srs,	Straw. Mds. srs.
Hissar oats	7 24	8 9
Local oats	11 8	12 0

The local variety was far ahead in respect of both grain and straw.

Mustard.

9. An experiment was made to contrast local against Raipur mustard. The foreign variety gave a yield of only 1 maund 5 seers of seed per acre against 5 maunds 38¾ seers obtained from the local variety.

Other crops.

10. Experiments were made with wheat and groundnut but they all came to an untimely end. Wheat failed because the land having remained water-logged during the rains could not be prepared in time, and as regards groundnut, the crop which had been growing with vigour was destroyed by flood.

Distribution of seeds.

11. The following quantities of seed were distributed from the Farm during the year:—

	Mds.	
Wheat (local Gangajali) ...	46	grown on Farm
Oats	23½	Ditto.
Barley	13½	Ditto.
Gram	8	Ditto.
Peas	3½	Ditto.
Darjeeling potatoes	140	Ditto.
Cowpeas	9½	Purchased locally.
Jowar	9½	Ditto.

Excepting the potatoes, cowpeas and jowar, most of the other seeds were supplied to the Farm Superintendents and the Superintendent, Seed Depôt, Dacca.

Receipts and expenditure.

12. The total receipts amounted to Rs. 1,646-6-9 and the expenditure to Rs. 9,480-5-4, including Rs. 2,186 for establishment and Rs. 3,459-2-10 for capital charges.

13. During the year the Director of Agriculture, and the Fibre Expert each inspected the Farm once, and the Second Deputy Director five times. The Collector of Rajshahi visited the Farm several times.

MAP
OF
JORHAT FARM

Scale 32 Inches = 1 Mile

ANNUAL REPORT OF THE JORHAT AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1910.

Introduction.

This station, established in the beginning of the year 1906, is intended principally for the investigation of sugarcane. It is situated about 3 miles south of Jorhat town. Its total area is 35½ acres, of which 1·7 acres is *hola* or ravine land, which has been cropped with winter rice for many years, and the remainder is high land, which was under grass and light scrub jungle before it was acquired.

Soil.

2. The soil of the high land is a reddish sandy loam belonging to the old alluvium. This class of soil is typical of considerable tracts in the Assam Valley and is cropped with sugarcane to some extent.

Four samples of soil and four of sub-soil have been analysed by the Imperial Agricultural Chemist, Pusa. A detailed statement of the analysis was tabulated in a previous year's report, so it will probably be sufficient to give here an extract of Dr. Leather's remarks.

"There is a great uniformity among these soils, and no appreciable difference exists between any of them. They are all deficient in lime. The amount of organic matter as indicated by the organic carbon and nitrogen is higher than is common to Indian soils. Although there is abundance of potash, the available portion is very small and that of available phosphate is also very small. The mechanical analysis shows the soil to consist almost entirely of moderately fine sand."

Preparation of the land for experiments.

3. When the land was acquired it was partially covered with jungle and the surface was uneven. The subsequent rooting up of jungle and levelling of the surface caused variability in the fertility of the soil. To remedy this it was proposed to divide the land into plots $\frac{1}{20}$ of an acre each or multiples thereof, and to crop these plots uniformly until they were reduced to an approximately equal state of fertility. This plan was carried out, the plots being separated by paths 2 or 3 feet wide, but since then we have decided to obliterate all plot divisions and to crop the land uniformly as far as possible in large blocks.

4. The farm is equipped with a godown, a combined office and rest-house for inspecting officers, quarters for Farm Superintendent and Fieldman-clerk and a *pucca* cattle shed.

Buildings.

A small strip of land (about 1·5 acres) adjacent to the Farm has been acquired on which to build huts for coolies.

5. The rainfall recorded during the growth of the crops referred to is given in the following table side by side with the normal rainfall :—

Rainfall.

Month.	Actual rainfall in inches.	Normal rainfall in inches.
1	2	3
1909, April	6·03	8·76
,, May	9·85	9·62
,, June	9·57	11·52
,, July	10·99	15·24
,, August	12·21	14·32
,, September	7·22	9·23
,, October	7·57	4·04
,, November	0·30	0·54
,, December	0·10	0·60
1910, January	0·72	0·93
,, February	0·82	1·4
,, March	4·49	4·28
Total ...	69·87	80·49

Experiments.

6. These included :—

I. Variety trials with plant and ratoon sugarcane.

II. Selection work with sugarcane.

III. Lime experiment.

Ratoon sugarcane.

7. The following varieties of cane which were mentioned in the previous year's report as having been planted on $\frac{1}{20}$ acre plots in May 1908 were ratooned and the results given here are for the first ratoon crop :—

Striped Mauritius.	B. 208.
Paunda.	B. 1753.
Kheri.	B. 376.
Samsara.	Vandamukhi.
Mag.	Dacca Ganderi.
Teli.	Paunla (from Dibrugarh).
B. 147.	Bogapura.

In the first year, the growth of most of these varieties was so poor and uneven due to lack of uniformity and poverty of soil, that no reliable results were obtainable. It was decided, however, to take a ratoon crop from the whole area.

The cane was harvested and crushed from January 27th to February 2nd, 1910.

The ratoon crop was a distinct improvement on the previous year's crop of plant cane, but out of the 14 varieties, 5 were not worth weighing, *viz.*, Bogapura, Vandamukhi, Paunda (from Dibrugarh) and Dacca Ganderi on account of poor growth, and B. 208 because it had been badly eaten by jackals.

The results of the remaining nine varieties are given in Tables I, II and III. Table I gives the analysis of the juice, Table II the weights of cane, juice and *gur*, etc., per acre and Table III the numbers of sound and diseased canes at crushing time.

TABLE I.

Ratoon cane 1909-1910.

Variety.	Juice.				Remarks.
	Cane Sugar per cent.	Glucose per cent.	Total sugar per cent.	* Glucose ratio.	
1	2	3	4	5	6
S triped Mauritius	16·00	0·42	17·52	2·48	
Kheri	14·37	1·17	15·54	8·14	
Mag	15·59	0·75	16·	4·81	
Teli	16·38	1·19	17·57	7·26	
Punnda	15·01	0·79	16·80	4·93	
B 376	17·74	0·26	18·00	1·46	
B. 147	17·69	0·35	18·04	1·97	
B. 1753	7·46	0·30	17·76	1·71	

* Glucose ratio=parts of glucose per 100 parts cane sugar.

The above figures shew a great improvement in the quality of the juice of all the varieties, as compared with the results obtained in the previous year. This is mainly due to the fact that ratoon cane of the year under report was much less attacked by disease than was the previous year's crop.

The Barbadoes varieties have maintained their positions as far as quality of juice goes, while Striped Mauritius runs them fairly close'y. As usual Kheri gives a comparatively low quality juice, but this is more than counterbalanced by ts greater yielding power.

TABLE II.

Ratoon cane 1909-1910 *per acre.*

Variety.	Yield of cane.	Yield of juice.	Percentage juice on cane.	Total Sugar per cent. on juice.	Total Sugar per acre.	Gur.
1	2	3	4	5	6	7
	lbs.	lbs.			lbs.	Mds. srs.
1. Striped Mauritius	39,460	22,840	57·9	17·	3,956	
2. Kheri	49,220	26,280	53·6	15 54	4,090	50 25
3. Paunda	21,820	13,860	64·4	16·8	2,328	31 10
4. Mag	22,540	14,060	62·4	6	2,301	30 0
5. Teli	20,520	11,600	56·5	17·57	2,038	24 25
6. B. 376	24,720	15,000	60·7	18·00	2,700	32 30
7B 1. 147	27,480	17,560	63·9	18·04	3,168	40 20
8. P. 1753	35,920	22,540	62·7	17·76	4,003	47 35
9. Samoora	24,400	13,680	56·0	not analysed.		28 0

Too much reliance must not be placed on the results given in Table II, since, as has been explained before, the growth on these plots was uneven; but they bear out generally the results obtained in previous years, that Kheri is superior from the point of view of yield alone, although its juice is comparatively low in quality, and that Striped Mauritius, by reason of the superior quality of its juice, is approximately equal to Kheri in respect of sugar production although the yield of cane is much less.

TABLE III.

Ratoon canes 1909-1910 *per plot.*

Variety.	Number of canes fit for crushing.			Diseased cane unfit for crushing.	Total.	Per cent. fit for crushing.			Unfit for crushing per cent.
	Sound canes.	Canes attacked by				Sound.	Borer.	Red-rot.	
		Borer.	Red-rot.						
1	2	3	4	5	6	7	8	9	10
Striped Mauritius	535	259	20	68	882	61	29	2	8
Kheri	1,618	324	18	42	2,002	81	16	1	2
Mag	464	165	50	21	706	66	23	8	3
Teli	779	215	81	9	1,114	70	22	7	1
Paunda	426	246	30	15	747	57	33	3	2
* B. 376	167	73	13	36	289	58	25	4	13
B. 147	510	96	44	10	660	77	15	7	1
B. 1753	810	60	21	58	979	83	9	2	6
Samsara	464	370	70	13	926	50	41	8	1

* Only ¼ acre taken.

The figures given under the columns headed "Borer" and "Red-rot" are for canes which were only slightly attacked and were not rendered unfit for crushing. All the varieties suffered to some extent. B. 1753 and Kheri have the largest percentages of sound canes, while Samsara, Paunda and B. 376 have the smallest. On the whole, these figures compare very favourably with those compiled for the previous year's ratoon cane, which ranged from 72 per cent. of sound canes in the case of Kheri to only 30 per cent. for Samsara.

Plant cane.

8. Block D was selected for this experiment. (See plan). The soil is a light sandy loam only about 6" to 8" deep, lying on a dirty yellow poverty-stricken subsoil. It is easy to work and is fairly retentive of moisture, but it is extremely infertile.

The whole block was green manured with a crop of cowpeas ploughed in during the rains of 1908. For the *rabi* crop Oats were sown on one portion of the block and Mustard on the other portion, but both crops died off soon after germination.

In the spring of 1909 the land was laid out in seven quarter acre plots and nine $\frac{1}{10}$ acre plots, with divisions of six feet between the plots, and a dressing of 500 maunds per acre of well rotted cowdung was ploughed in.

The following varieties of cane were planted in the beginning of May 1909 on quarter acre plots :—

1. Samsara.
2. Dacca Ganderi.
3. Paunda (from Dibrugarh).
4. Striped Tana (from Bihar).
5. Mag.
6. B. 147.
7. B. 208.

And the following varieties on $\frac{1}{10}$ acre plots :—

8. Striped Mauritius.
9. Teli.
10. B. 1753.
11. B. 376.
12. Bogapura.
13. Vandamukhi.
14. Samsara.
15. Kheri.

One variety, *viz.*, Striped Tana (from Bihar), was included for the first time.

The sets were planted as in previous years in shallow trenches about 6″ deep and three feet apart, with a space of two feet between the sets in the lines.

The crop was given two earthings during the rains.

Harvesting was commenced on the 18th April 1910 and was concluded on April 28th. The growth of the Samsara, Dacca Ganderi and Bogapura varieties was so poor that the cane was not considered worth crushing, so it was cut and fed to the cattle; while Paunda and B. 208 were found to be riddled with borer and red-rot and had to be rooted up and burnt.

The following areas of the remaining varieties were taken for weighment and analysis:—

Striped Mauritius ...		
Teli ...		
B. 1753 ...		$\frac{1}{20}$ acre each.
B. 376 ...		
Vandamukhi ...		
Kheri ...		
B. 147 ...		$\frac{1}{8}$ acre.
Mag ...		
Striped Tana ...		$\frac{1}{16}$ acre.

On examining the plot of Striped Tana it was found to consist of a mixture of striped canes and canes of a yellowish red colour. The two types resembled each other in every respect except in colour. We have therefore decided to keep the two types separate in future to ascertain whether the striped type will split up again.

The results of the nine varieties crushed are given in the following tables. Table IV gives the analytical results, Table V the weights of cane juice and sugar, etc., per acre, while Table VI is an attempt to compare the respective disease-resisting powers of the different varieties by giving the numbers of sound and diseased canes found at the time the cane was harvested.

TABLE IV.

Plant Cane, 1909-1910.

Variety.	Juice.			
	Cane sugar per cent.	Glucose per cent.	Total sugar per cent.	Glucose ratio.
1	2	3	4	5
1. Striped Mauritius	17·87	0·24	18·11	1·34
2. Kheri	15·56	0·79	16·35	5·07
3. Mag	15·92	0·45	16 37	2·82
4. Teli	15·18	0·97	16·15	6 39
5. Vandamukhi	16·91	0·30	17·21	1·77
6. B. 1753	16·30	0·23	16 53	1·41
7. B. 376	17·15	0·19	17·34	1·10
8. B. 147	17·35	0·40	17·75	2·30
9. Striped Tana	14·21	0·59	14·80	4·15

Striped Mauritius heads the list as the variety richest in sucrose and total sugar. As in previous years, Kheri gives a much lower quality juice than the thicker varieties

The new variety Striped Tana is disappointing as being the worst variety from the point of view of sugar content.

The Barbadoes varieties, although analysing well, are lower in cane sugar and rather higher in glucose content than they were last year. In fact, instead of becoming acclimatised, they appear to be going back.

TABLE V.

PLANT CANE, 1909-1910 PER ACRE.

Variety.	Yield of cane.	Yield of juice.	Percentage juice on cane.	Total sugar per cent. on juice.	Total sugar per acre.	Gur per acre.
1	2	3	4	5	6	7
	lbs.	lbs.			lbs.	Mds. srs.
1. Striped Mauritius	45,980	29,700	64·7	18·11	5,379	62 30
2. Kheri	58,840	34,040	59·4	16·35	5,713	74 5
3. Mag	29,952	19,480	65·0	16·37	3,190	41 30
4. Teli	33,560	19,880	59·2	16·15	3,211	43 20
5. Vandamukhi	33,440	21,220	63·4	17·21	3,655	48 5
6. B. 1753	23,160	13,380	58·6	16·53	2,244	30 5
7. B. 376	20,000	12,120	58·0	17·34	2,102	26 10
8. B. 147	23,264	14,920	64·1	17·75	2,648	33 24
9. Striped Tana	57,776	34,672	60·0	14·80	5,131	72 8

The above table demonstrates the superiority of the yielding powers of Striped Mauritius, Kheri, and Striped Tana over those of the other varieties.

From the sugar manufacturers' standpoint Striped Mauritius stands first, as it combines a comparatively high yield with good quality juice.

Kheri gives the largest yield of cane and juice, and in this respect is run very close by Striped Tana, but the juices of these varieties are lacking in quality and this brings down the amount of sugar per acre. The Barbadoes varieties, although giving fairly rich juices, show very poor yields. This is probably due to the fact that they have not yet got accustomed to the changed conditions of soil and climate.

TABLE VI.

PLANT CANE 1909-1910 PER PLOT.

Variety.	Number of canes fit for crushing.				Diseased canes unfit for crushing.	Total.	Per cent.				Diseased canes unfit for crushing, per cent.
	Sound canes.	Canes attacked by					Canes fit for crushing-				
		Borer.	White ants.	Other diseases.			Sound.	Borer.	White ants.	Other diseases.	
1	2	3	4	5	6	7	8	9	10	11	12
1. Striped Mauritius	710	130	30	106	17	993	71	13	3	11	2
2. Khori	1,373	976	...	98	62	2,509	55	39	...	4	2
3. Mah	1,238	749	25	145	293	2,469	51	30	1	6	12
4. Teli	937	194	67	46	45	1,289	73	15	5	3	3
5. Vandamukhi	1,035	190	20	22	48	1,325	78	14	2	2	4
6. B. 1753	674	168	24	68	5	939	72	18	3	7	1
7. B. 376	406	258	13	15	18	705	58	36	2	2	(less than) 3
8. B. 147	1,344	326	36	16	39	1,760	76	18	2	1	2
9. Striped Tana	110	687	24	43	70	934	12	73	3	5	7

In the above table the crushable canes put under the heads " Borer ", "White ants," etc., were only very slightly attacked and their value for crushing was very little diminished. The canes mentioned as being unfit for crushing were entirely spoilt and had to be burnt.

Borer is still very prevalent, although not so bad as in the previous year. Most of the canes appeared to have been attacked late in the season and were thus not damaged very much.

The Striped Tana variety was worst as regards borer and that probably partly accounts for the extremely poor quality of its juice.

Sugarcane—general remarks.

9. This year's results clearly demonstrate the superiority of the two varieties, Striped Mauritius and Kheri, in both plant and ratoon cane.

Kheri is the heaviest cropping variety, but its juice is rather low in sucrose and high in glucose and thus it is not suited for the manufacture of refined sugar. Its chief recommendation lies in the fact that it is an extremely hardy cane, a good cropper on poor soil, and is not liable to injury by jackals and wild pigs. It has two faults, first the low quality of its juice and secondly its habit of retaining its dead leaves firmly fixed to the canes, which makes stripping laborious and largely increases the amount of labour required to prepare the cane for the mill. It is this property, however, which makes the cane immune from the attacks of wild animals.

Striped Mauritius is not very far behind Kheri in respect of cropping power and its juice is of a much higher quality. For the manufacture of refined sugar it is much to be preferred. Although a fairly hard cane, it is more delicate than Kheri and requires more protection from wild animals.

Unlike Kheri, it is a clean growing cane, the dead leaves falling off naturally, so that it requires the minimum amount of labour to prepare it for the mill.

Kheri is a variety suitable for a cultivator who cannot afford to give his cane much attention and protection and whose object is to obtain a big yield of *gur* at the least possible cost; while Striped Mauritius would suit the man who is going in for the production of sugar and who is willing and able to give his cane some care and attention.

This year we are giving a final trial on a larger scale to all the varieties of sugarcane and in our next report we hope to be able to definitely recommend one or two varieties as being the best on a certain type of soil in Assam.

This year we have eliminated four varieties, *viz.*, Dacca Ganderi, Samsara, Paunda and Bogapura, as being unsuitable, and next year we hope to reduce the number of varieties still further.

Selection work with sugarcane.

10. Prior to 1909, a certain amount of selection work had been done with a few varieties, by picking out a few of the best clumps of cane from each plot and planting them separately, but no records were kept of the characteristics of the selected clumps and their progeny.

In the spring of 1909 a commencement was made to test the value of selection by actual measurements and careful notes of all selected clumps and their progeny.

From the plots of plant cane four of the best clumps of each of the following varieties were selected :—Kheri, Mag, Teli, Vandamukhi, B. 147, B. 208, B.1753, and B. 376.

Striped Mauritius was also selected, but the clumps got mixed before planting. The clumps were selected for :—

I. Freedom from disease.
II. Tillering power.
III. Height and thickness of canes.
IV. Length of internodes.
V. General vigour and appearance.

A record was made of the number of canes per clump, length and girth of canes, and length of internodes by actual measurement.

Each clump was then cut up into sets, and twelve sets of each clump were planted in lines, a separate line for each clump.

By selecting annually from the progeny of the selected clumps we hope to be able in a few years to build up improved strains of the existing varieties.

Lime Experiment.

11. In the previous year's report it was stated that *rabi* crops have invariably been a failure on this farm, and that this was not altogether due to lack of moisture, since there was apparently sufficient moisture in the soil to carry the crops through the cold weather.

With the object of ascertaining whether this state of affairs was due to a lack of lime in the soil, a small experiment was commenced at the end of the rains 1909.

A strip of land (Block G. in plan) which had carried a crop of *aus* paddy in the rains was divided into two equal portions longitudinally; one portion was given a dressing of 50 maunds of slaked lime per acre and the other portion remained untreated. At the end of October strips of Oats, Linseed, Gram and Mustard were sown across both limed and untreated portions. No further manuring was given. The result was remarkable. The crops germinated fairly well on both the limed and untreated land, but shortly afterwards all the plants on the untreated land died off. The Mustard on the limed land also died out after struggling for sometime, but the Oats, Linseed and Gram grew fairly well and were harvested in April.

The following table gives the produce of these crops per acre. The yields are extremely poor, but the fact that the crops grew at all on the limed land, while they died out on the untreated land, demonstrates the fact that lime is a very important factor to be considered when dealing with this type of soil.

PER ACRE.

Crop.	Grain.		Straw.		Total.	
	Mds.	srs.	Mds.	srs.	Mds.	srs.
Oats	5	24	8	32	14	16
Linseed	3	0	8	16	11	16
Gram	0	28	10	22	11	10

Groundnuts.

12. This crop was tried for the first time at Jorhat in 1908 on about $\frac{1}{5}$ acre of land. The crop did remarkably well and was free from disease, but it attracted swarms of rats which destroyed a large proportion of the nuts. The yield amounted to $20\frac{1}{2}$ maunds of nuts per acre.

The crop was tried again in the year under report on $1\frac{1}{5}$ acres of land in Block C. The land was manured at the

rate of 150 maunds of cowdung per acre and the nuts were planted at the end of May and harvested in December. Although precautions were taken against rats and many were trapped and poisoned, yet they did more damage than in the previous year. The plants grew well and promised a heavy yield of nuts, but only 14½ maunds of nuts were obtained. The rats probably accounted for at least two-thirds of the crop.

Other crops.

13. *Jowar* was sown as a *kharif* crop for fodder on the whole of Block A except the portion under ratoon sugarcane. The crop did very badly. A portion of the land was dressed with 150 maunds of cowdung per acre and *jowar* was resown, but the result was most unsatisfactory.

The only portions on which the *jowar* made much growth were two small plots which had received a small dressing of lime in the previous year's sugarcane experiment. In view of this fact the land was dressed with 50 maunds of slaked lime per acre at the end of the rains and sown with *Mati kalai* as the *rabi* crop, which grew fairly well, giving a yield of 9½ maunds of grain.

Mati kalai.

Matikalai was also sown on the whole of Block B without manure, but the crop was practically a failure.

Cowpeas.

Cowpeas were sown on the whole of Blocks E and F. The land was previously treated with slaked lime at the rate of 50 maunds per acre. The crop grew very luxuriantly and was ploughed in for green manure in August 1909. The land remained fallow throughout the cold weather in preparation for the following year's sugarcane crop.

Potatoes.

Darjeeling and Nainital varieties were tried on small plots in the kitchen garden together with other English vegetables. The whole of the kitchen garden was limed at the rate of 50 maunds of slaked lime per acre and received in addition about 250 maunds of cowdung per acre.

The English vegetables did well, especially, peas, beans, cauliflowers and tomatoes. The potatoes gave a poor yield for a garden crop, only amounting to 90 maunds per acre. The tubers were attacked badly by red ants.

Fruit Trees.

14. These have been handed over to the Economic Botanist. The orchard has been given a dressing of 50 maunds of slaked lime per

acre and it is proposed to grow a crop of cowpeas for green manure between the trees.

The litchi trees are making good growth, but up to the present have borne very little fruit. Pine-apples, both local foreign varieties, are doing well.

Receipts and Expenditure.

15. The receipts amounted to Rs. 1,126-5-6 (chiefly by sale of gur) and the expenditure to Rs. 9,034-0-2, including Rs. 2,355-11-0 for Establishment and Rs. 657-4-5 for "Capital charges".

Establishment.

16. The establishment consists of a Farm Superintendent on Rs. 100-10-200, a Fieldman-clerk on Rs. 25—1-8—40 and a peon on Rs. 8.

There are also two Assamese apprentices under training on stipends of Rs. 15 per month.

Inspection.

17. The Offg. Director of Agriculture inspected the Farm once during the year. The Agricultural Chemist visited the Farm several times and stayed a considerable time there in January and April in connection with the analysis of sugarcane, and I stayed there for a few days on eight occasions.

APPENDIX.

Programme of work, 1909-1910.

Plant Sugarcane.

1. Block E.—The following four varieties of cane are being grown on $\frac{1}{4}$ acre plots :—

1. Striped Mauritius.
2. Tana { $\frac{1}{2}$ plot striped. / $\frac{1}{2}$ „ Yellow.
3. Mag.
4. Kheri.

And the following six varieties on $\frac{1}{10}$ acre plots.

1. B. 147.
2. B. 1753.
3. B. 376.
4. B. 208.
5. Teli.
6. Vandamukhi.

Divisions 6 feet wide have been left between the plots. The remainder of the area has been planted with non-experimental cane.

The whole of the land was manured with 500 maund per acre of well-rotted cowdung, ploughed in about 6 week before planting. The sets of all varieties were sprouted in seed beds before planting.

Selection work is being continued on the lines described in the report, but this year only top cuttings of canes of selected clumps have been planted.

Ratoon Sugarcane.

2. Block D.—The whole of last season's plant cane has been left for ratoon except the varieties noted in the report as having been rejected from future experiments. All ratoon canes will receive 20 maunds of oil-cake per acre, half at the first earthing and half at the second earthing.

Ground nuts.

3. Ground nuts are being tried again on Block F, which has been manured with 150 maunds of cowdung per acre. Special precautions are being taken to protect this crop against rats by laying poisoned baits and traps.

Cowpeas.

4. Cowpeas for green manure will be sown on the whole of Blocks A and B. The whole of Block B and the portion of Block A, which carried ratoon

sugarcane last season, have been treated with slaked lime at the rate of 50 maunds per acre. After green manuring, Block A will be sown with Mustard for the *rabi* crop and Block B will be reserved for next year's sugarcane experiments.

Aus Paddy.

5. *Aus* paddy has been sown on Blocks C and G. Block C will be reserved for experiments to ascertain the proper quantity of lime to apply to this soil and also the frequency of application.

Ashes as manure.

6. A small experiment has been commenced on a piece of land in Block D outside the sugarcane area to ascertain how far ashes from the sugar-boiling furnaces can take the place of lime in manuring. At present this land is cropped with *Aus*.

Potatoes.

7. Darjeeling and Nainital potatoes will be tried again (this year with irrigation) in the kitchen garden, together with a selection of English vegetables.

Power-Crushing plant.

8. In view of the increase in the area of land put under sugarcane on this Farm and the difficulty of dealing with large plots with the bullock-driven sugar mills, it has been decided to install a three roller horizontal power-crusher driven by an oil-engine. We hope to have the plant ready in time to crush all next year's cane.

ANNUAL REPORT OF THE FRUIT EXPERIMENT STATION, SHILLONG, FOR THE YEAR ENDING THE 30TH JUNE 1910.

Introductory.

The Fruit Experiment Station and the Upper Shillong Agricultural Station are worked practically as one concern. Some of the fruit trees imported from abroad have been planted in the Farm at Upper Shillong and are dealt with in this report along with the trees in the Fruit Garden.

History and description of the garden.

2. The Fruit Garden commenced work in September 1902. It is situated in the village of Umlyngka, 3 miles from Shillong, on the Cherrapunjee road, nearly midway between the town and the Upper Shillong Station. Its elevation is about 5,200 feet, *i.e.*, about 200 feet higher than the town. The total area of the garden is about 15½ acres. About two-thirds of this area has been brought under cultivation and planted for the most part with fruit trees and mulberry.

The chief object with which the garden was established was to experiment with various kinds of fruit trees grown in the temperate climates of Europe with a view to introduce such of them as may succeed into the Hill Districts which possess a temperate or semi-temperate climate resembling in respect of heat that of the warmer regions of Europe. The great drawback in the climate of these districts is the excessive rainfall which, often beginning as early as April, seriously interferes with the ripening of fruit.

Another serious impediment to the successful growing of European fruit at Shillong is the great prevalence of beetles and other insect pests against which few trees and fruits are immune. The insects breed in the pine forests which abound in and around Shillong and appear in legions too fast to be killed by any measures that we could devise. Much harm also results from the attacks of fungus diseases which are fostered by the excessive humidity of the air.

The greater portion of the garden is exposed to the gales which blow from the south and west in March, April and May, and knock off the blossom and fruit which appear at

this time. This drawback was not anticipated in the beginning, but experience has shewn it to be a very serious one. To remedy it, a proposal has been mooted to abandon the present site and remove the garden to a situation well sheltered from the prevailing winds.

Such fruits as pears, apples, plums and peaches are already grown in and about Shillong, but the fruit in almost every case is of an inferior description.

The bulk of the fruit trees were obtained from England in the winter of 1902-1903 ; a few were imported in subsequent years. Some apples, pears and Spanish chestnuts were obtained in 1902-1903 from the Saharanpur Botanical Garden. Cuttings of several varieties of grape vines were obtained in 1903 from Kashmir. Several species, *e.g.*, Cherimoyer and tree tomato, have been propagated from imported seeds. A large number of grafts and cuttings produced in the garden have been planted from time to time.

Besides the foregoing the garden contains small plantations of strawberries, citrons, Khasi oranges, rhubarb and asparagus. A large portion of the garden has been planted with mulberry for the sake of rearing silkworms and also for the supply of plants and cuttings to those who intend to engage in sericulture.

The only plants imported during the year under report were six hybrid raspberry suckers from the Government Garden at Pachmarhi, C. P.

An important part of the work carried on at the Fruit Station is the propagation of fruit trees with a view to their distribution to the public. The garden contains a large number of stocks of wild apple, wild pear, peach and plum which have been planted for this purpose.

3. A statement annexed to this report shows the fruit trees which remained alive on the 30th June 1910.

Number of fruit trees at the close of the year.

The following is an abstract of the statement. It also shews the number of grafts, rooted cuttings, etc., standing in the nurseries at the close of the year :—

No.	Species of trees.	Number of trees standing on 30th June		Number of grafts in nursery on 30th June	
		1909.	1910.	1909.	1910.
1	2	3	4	5	6
1	Apple	49	46	51	
2	Pear	213	199	556	476
3	Plum	47	46	...	...
4	Peach	30	28	11	1
5	Cherry	98	86	1	...
6	Apricot	9	9	1	1
7	Almond	5	5	...	...
8	Walnut	17	17	...	...
9	Fig	49	44	16(a)	...
10	Grape	142	127	101(a)	389(a)
11	Spanish Chestnut	75	75	173(b)	1540(b)
12	Cherimoyer	6	6	...	...
13	Tree Tomato	41	34	5(b)	...
14	Mountain Papaya	26	6	7(b)	6(b)
15	Loquat	3	3	...	...
16	Guava	5	4	...	...
17	Khasi Orange and Citron	105	12	...	1
18	Gooseberry	3	2	...	...
19	Raspberry	8	12	4	...
20	Currant	15	12	...	...
21	Nectarine	9	8	13	...
22	Quince, common	7	3	...	...
	Total ...	897	840		1,454

(a) Rooted cuttings.
(b) Seedlings

Weather.

4. The season (spring and early summer of 1910) has been very wet. Most of the trees which have come into bearing put forth plenty of blossom and formed a great deal of fruit, but most of the fruit fell off the trees while still young.

Progress of the fruit trees.

5. The majority of the exotic fruit trees on the station have not been very successful up to the present. Generally the conditions at the time of setting fruit are unfavourable, and most fruit get knocked off the trees by wind and rain before it has had time to ripen. This particularly has been the case with cherry and apple. The loss of young fruit is due to some extent to injuries caused by insect and fungus pests. The progress of each species of tree is noted below.

Apple.—There are 46 trees belonging to 14 different varieties. Of these 46, four (Freeman's apple) have been inherited from the old Model Farm and are over 30 years old; and 18 are grafts made locally with scions taken from the imported trees. Of the remaining trees, 7 came from Saharanpur and the remainder from England in 1903. Almost all the imported apple trees have grown very well and many of them have been in bearing for two or three years past, but none have succeeded in carrying the fruit to maturity. Thomas Rivers and Kerry Pippins bore well this year, but the fruits fell off before ripening. Two old apple trees (Freeman's) have produced a large crop of fruit every year, but the fruits are so badly worm-eaten as to be almost uneatable. Formerly we used to wash and spray these trees, but found it impossible to reduce the extent of injury by insects which besides damaging the fruits cause them to shed before they were properly mature.

Pear.—Fifteen different varieties have been planted. Of these three varieties (Keiffer, La Conte and China) came from Saharanpur in 1903, and 10 from England in the same year. One is the kitchen pear now so common at Shillong, and one variety has been propagated from a tree in the late Mr. Rossenrhode's garden and is now known as Rossenrhode's pear. There are 190 pear trees in the Fruit Garden and Upper Shillong Farm; of these as many as 173 belong to the Rossenrhode variety. None of the English pears have grown well, and all of them remain more or less stunted. The Saharanpur plants have grown into large trees, and come into bearing. The China pear trees differ

in no respect from the common Shillong pear and are therefore of no special value. They produced some fruit this year. La Conte bore last year, but gave no fruit this year. The three Keiffer trees flowered profusely, but only one produced a single fruit which was stolen when about half-grown. I know of some grafted La Conte and Keiffer trees in Khasia gardens which have been propagated from buds taken from the trees in the Fruit Garden, and have begun to bear. The fruits are sweeter and of better flavour than the common Shillong fruit. None of the Rossenrhode pear trees has yet come into bearing, the oldest graft having been planted only four years ago. The two parent trees in Mr. Rossenrhode's garden have been producing small crops of fruit for some years past. It is a luscious melting fruit, very different from the ordinary cooking pear of Shillong. Several hundred grafts of this pear have been produced; some have been distributed among private individuals; a large number have been planted in the Fruit Garden as mentioned above, and are growing very well; and two hundred and sixty young grafts are now standing in the nursery and awaiting disposal. There is every reason to hope that this variety will succeed and spread in the Khasi Hills.

Plum.—There are 46 trees representing 21 varieties, mostly imported from England in 1903. Most of the trees remain stunted in growth and look unpromising. A few trees have grown to a tolerable size. The plum trees have suffered greatly every year from the depredations of beetles which we have found unable to cope with. A few trees belonging to Czar, Early Rivers, Belgian Purple and an unnamed variety bore a few fruits this year, but only a single fruit could be saved from theft. It was found to be of good quality.

Peach.—There are 29 trees belonging to eight different varieties. Twelve of these were produced on the garden by grafting. The peach trees have grown extremely well and several of them have been in bearing for some years past. The fruits are of fairly good quality, especially those of the Early Silver and Royal George varieties, though as regards appearance and sweetness they cannot approach peaches grown in Europe. A large proportion of the crop is spoiled by beetles and flies which attack the fruit when it is about to ripen.

Nectarine.—There are eight trees, six of which came from Saharanpur in 1907 and two were produced locally by grafting buds from the Saharanpur trees on to the common peach. All the trees have grown well. Four trees bore numerous fruits this year. The fruits however cracked and rotted on the trees and none came to maturity in sound condition. The climate is evidently too wet to suit this fruit.

Quince.—There are eight of them; seven came from Saharanpur and one produced locally by layering. The oldest of them are only three years old. All the trees are growing well.

Cherry.—There are 36 trees belonging to 16 different kinds. All but one came from England in 1903. A few trees have grown to a good size, but many remain more or less stunted. Several trees have been flowering and setting fruit for three or four years past, but none was able to carry the fruit to maturity. The cherry trees like the plums suffer badly every year from the ravages of beetles.

Apricot.—There are nine trees, three having come from England in 1903 and six from Saharanpur in 1906. Most of the trees have grown well. Two of them (one Royal and one Oullins Early peach) bore large fine looking fruits this year, but unfortunately they were stolen just as they were about to be picked. There is no doubt that apricot will do well at Shillong. I have seen an apricot tree in Mr. C. H. Holder's garden loaded with fruit. To encourage its cultivation, we have recently imported three dozen grafts from Saharanpur and sold them at half price among residents of Shillong.

Almond.—There are five trees in all. Two of them have grown to a decent size, three have ceased to grow and remain stunted. Four trees have been flowering and setting a few fruits every year for some years past, but the fruits never come to maturity. The almond trees too are badly damaged every year by the beetle pest.

Walnut.—Seventeen, all raised from Kashmir seed and planted out 1905. The trees are growing well in spite of the check they receive every year from the ravages of insects. It will take several years more before these trees begin to bear. There are old walnut trees at Shillong which are now in bearing. This fruit is expected to succeed in the Khasi Hills.

Fig.—Eleven varieties of fig have been planted. One variety came from Poona in 1907: the rest are English

varieties obtained in 1903. There are 44 trees in all. All the trees from England except one (a Black Ischia) have been gradually killed off by borers; those now in the garden have been produced from cuttings taken from the original English trees. Some of the fig trees are in bearing and produce a good show of fruit. The fruits ripen during the latter part of the rainy season and are somewhat watery and insipid. These which form late in the season are killed by cold and frosts and fail to ripen.

Grape.—Fifteen varieties have been planted. They came originally from England or from Kashmir. Most of the varieties from Kashmir bear French names. There are also some vines of the common Shillong black grape, the origin of which is not known. Several vines have borne more or less fruit, but in every case the fruit is so badly damaged by fungus disease as to be almost worthless. The only exception to this rule is the Shillong black grape which is almost immune to the disease, but its fruit is sour and of little value.

Spanish Chestnut.—Besides the old plantation in the Upper Farm which has existed since the time of the Model Farm and contains 54 trees, there are 21 trees which were obtained from Saharanpur in 1903. These have grown into fairly large trees and three trees have begun to bear. The old trees in the Upper Farm blossom profusely every year, but produce only a scanty crop of nuts.

Cherimoyer.—There are six trees which have attained a good size. They have been flowering since 1908, but have never set fruit. Pollinating the flowers was tried this year, but with no result.

Tree tomato.—There are 34 trees in the Fruit Garden. We have not succeeded in keeping the tree alive more than three years. It is killed sooner or later by a species of blight akin to the potato disease. Bordeaux Mixture has been used, but with little apparent effect. The tree tomato is, however, very readily propagated from seed, and the plant comes into bearing early in the second year. The best method of raising this fruit would be to grow a succession of new plants and keep them on for three years. The trees now in the Fruit Garden are bearing a large number of fruits and these will ripen soon.

Mountain papaya.—This tree was raised from seed obtained from Ceylon. Most of the old trees have gradually

died off, and only six are now alive. These trees are now bearing a small crop of fruit.

Loquat.—There are three trees seven years old. They have grown well, but are not yet in bearing I am sceptical as to loquat succeeding at Shillong. There are many large loquat trees in the station, but it is rarely that they produce any fruit.

Guava.—There are 4 trees, 2 of which (1 Smooth Green and 1 Guinea) have grown very well and are now in bearing. The elevation of the Fruit Garden seems somewhat too high to suit this fruit. The fruits begin to form about August and very few get time to ripen before the arrival of winter.

Khasi orange and citron.—There is a large plantation of these in the Fruit Garden. The orange trees are too small yet to bear. Some of the citron trees are in bearing, but the fruit has proved disappointing.

Raspberry, gooseberry and currant.—These have proved a failure with us. In the rains the bushes become diseased and the young shoots die back, and practically no fruit is produced. We have tried spraying and other remedies for the blight, but with no effect. The majority of the bushes imported from England have died out. Some plants of a new hybrid variety of raspberry were obtained in March last from the public garden at Pachmarhi, Central Provinces. These plants are growing with unusual vigour and have commenced to flower. It remains to be seen what the fruit is like.

Treatment of the fruit trees during the year.

6. All the grape vines, figs, quinces, almonds, walnuts and bush fruits as well the more backward of the apple, pear and plum trees were manured with cowdung. The peaches, apples, pears, almonds and apricots were lightly pruned. No root pruning was done during the year. Scale insects were found on some cherry, mulberry and orange trees, and were destroyed by applications of rosin wash. Some of the peach trees were found infested by aphis, which caused the leaves to curl, and were sprayed with a decoction of tobacco with excellent effect.

I consider it my duty to state here that the fruit trees have received little attention during the past two years. Many of the trees have grown to a large size and do not

require the same attention as before. But there still remain a large number of trees which might have benefited from a more intensive system of cultivation, manuring and pruning than we gave them. The results obtained from the trees which have come into bearing have been extremely disappointing, and this cause chiefly accounts for the fruit trees receiving less attention now than in former years. Another reason is the fact that the Farm Superintendent, U Herrick Singh, is able to give only a fraction of his time to the Fruit Garden. He used formerly to live on the place, but since August 1908 he has lived at the Upper Farm and paid only occasional visits to the Fruit Garden. Moreover, his duties are so varied and extend over such a large area, that I do not consider it possible for him or for any man in his position to give close personal attention to all items of work. If the Fruit Garden is to be maintained, it is very desirable that the officer in charge should devote his whole time to it, and if possible he should be a man possessed of a thorough knowledge of the culture of fruit trees.

Mr. Proudlock's visits.

7. Mr. R. L. Proudlock, Arboricultural Expert, visited the Fruit Garden twice during the year. He has furnished us with a detailed report on the condition of the fruit trees, and made a number of suggestions for the improvement of the garden, the chief among which are concerned with the proposal to shift the garden to a more sheltered situation and a more intensive system of culture than we have been accustomed to follow.

Strawberries, rhubarb and asparagus.

8. These crops have been successfully grown for several years past. Four varieties of strawberry are grown—Aprikose, Louise Gautier, Givon's Late Prolific and Alpine. Some old strawberry beds which had been bearing for several years were abandoned during the year. On about half of the present

area the plants were three to four years old and yielded less fruit than before.

The year's results from the three crops were as follows:—

	Strawberry.	Rhubarb.	Asparagus.
1	2	3	4
Area in square yards	1,064 = ·22 acre.	1,283 = ·26 acre.	907 = ·19 acre.
	Md. Srs. Ch.	Md. Srs. Ch.	Md. Srs. Ch.
Yield	0 23 9	1 5 2	0 33 0
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Value of yield	35 6 0	34 4 9	41 4 6
Cost of cultivation	86 14 11	24 3 0	29 14 10
Profit	.....	10 1 9	11 5 8
Loss	51 8 11	.....	.....

Groundnut.

9. This crop was tried for the second year on $\frac{1}{5}$th of an acre of land. It was manured with 300 maunds of cowdung per acre and sown with 14 seers of seed in the last week of April 1909. The crop came up and grew well for some time, but towards the end of the rains it was badly attacked by a fungus disease which was identified by the Imperial Mycologist to be the same as the *ticca* disease of Western India. The same disease was observed in the groundnut crop grown last year on the Burirhat Farm. The crop was taken up in December and gave a yield of 1 maund 18½ seers of nuts equivalent to an outturn of 7 maunds 13 seers per acre. The cost of cultivation amounted to Rs. 29-7-10. The nuts have not yet been sold and are not expected to fetch more than Rs. 8 per maund. The crop has, therefore, failed to pay. Apart from disease, the crop is not expected to pay on the higher hills owing to ground frosts which kill it before it is due to mature.

Sericulture.

10. European silkworms were reared for the seventh time last spring (1910). An experiment had been in progress for three years past in raising seed locally and testing it against imported seed. Last year we found that the fourth generation of French *Var* raised from our own seed produced cocoons which were quite as good as those raised from imported seed. We raised a fresh stock of seed from the fourth generation and intended to use it in this year's rearing, but through the carelessness of the garden staff the seed happened to be destroyed by rats, and thus an experiment which had already given most encouraging results came to an untimely end. It was proposed to raise a fresh stock of seed this year, but the worms grown this year having been badly diseased, the idea had to be abandoned.

This year's rearing was entrusted to a Khasia youth who had been working on the garden for some time under an arrangement which allowed him a share of the gross produce. One and three-quarters of an ounce of newly imported *Var* seed was used. The worms throve well in the early stages, but towards the end they were allowed, for want of sufficient accommodation, to remain too much overcrowded on the feeding trays; and the rearer also neglected to observe due precautions in the matter of cleaning and feeding the worms. The result was that the worms failed to attain the right size and a large proportion of them fell a prey to flacherie and other diseases to which the silk-worm is liable. The rearing did not fail wholly, but the result on the whole was very disappointing. The total yield of green cocoons was 1 md. 18 srs. 4ch. If the rearing had been as successful as in past years, twice that outturn might have been obtained. The cocoons were found on examination to be smaller in size and to contain less silk than those raised in previous years.

The green cocoons were killed and dried in a baker's oven at a maximum temperature of 180F. It took about 10 hours to dry the cocoons to about a third of their original weight. The plan of drying cocoons in a baker's oven was tried for the first time this year. It may solve the difficulty which we have hitherto experienced in drying cocoons by the ordinary method of exposure to the sun which in a wet climate like that of the Khasi Hills can never be relied upon. It remains to be seen whether exposure to a comparatively high temperature like 180F. has injured the texture and strength of the silk in any way. A sample of cocoons has been submitted to a firm of silk merchants in Bengal for report.

Two Khasia youths have returned after receiving a full course of training in sericulture at the Rajshahi School and a third boy was sent for training in January last. The first two men have not yet been able to do any rearing on their own account, their mulberry plantations not being yet ready. The uncle of the boy who is now at Rajshahi has got some mulberry trees at Mahadeo, below Cherrapunjee, which are old enough for plucking. He was given an ounce of *Var* seed free of charge. Owing to unusually heavy rains in April he was unable to feed his worms properly, with the result that he got only a scanty outturn of cocoons (12 seers).

Several others are known to have planted mulberry with the intention of rearing silkworms. The prospect of sericulture spreading in the Khasi Hills seems hopeful, though so far the progress made is not very visible.

11. The following table gives a list of plants and seeds distributed from the Fruit Garden during the year :—

(Distribution of plants and seeds.

Statement showing the distribution of plants and seeds during the year ending 30th June 1910.

No.	Description.	Quantity.	No.	Number supplied. of Khasias	Number supplied. of others	Total.
1	2	3	4	5	6	7
1	Asparagus seedlings	...	613	1	7	8
2	„ seed	½oz.	...	...	1	1
3	Rhubarb seedings	...	497	4	10	14
4	Strawberry plants	...	1,024	...	9	9
5	Potatoes	Mds. srs ch 53 18 8	...	...	8	8
6	Squash seeds	...	16	2	4	6
7	Peach grafts	...	10	1	2	3
8	Apple grafts	...	10	...	2	2
9	Grape rooted cuttings	...	28	1	5	6
10	„ cuttings	...	24	1	1	2
11	Pear grafts	...	38	1	7	8
12	Spanish chestnuts	...	24	...	4	4
13	Fig cuttings	...	24	...	2	2
14	Mulberry rooted cuttings	...	1,006	1	1	2
15	Loquat cuttings	...	6	...	1	1
16	Soybean seed	ch. h 4	...	...	1	1
17	Silk worm eggs	2½oz.	...	2	1	3
18	Soh-shur plants	...	2	...	1	1
19	Sohphoh	...	2	...	1	1
20	Almond cuttings	...	18	...		1
21	Horse chestnuts	...	30	...	1	1
22	Raspberry plants	...	12	...	1	1
23	Bay leaf oil	4oz.	...	...	1	1
24	Lemon grass oil	6oz.	...	...	1	1
	Total	...	...	14	73	87

12. The receipts and expenditure of the Fruit Garden were not kept separate from those of the Upper Shillong Farm. The total receipts and expenditure of the two stations will be found in paragraph 17 of the Annual Report of the Upper Shillong Farm.

Receipts and expenditure.

Shillong, the 19*th August* 1910.

B. C. BASU,

Deputy Director of Agriculture, Eastern Bengal and Assam.

STATEMENT

Showing the number and description of fruit trees at the Fruit Station and the Upper Farm at the close of June 1910.

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Apple ...	Golden Reinette ...	England ...	September 1903 ...	...	1	
			July 1904 ...	1	...	
	Kerry Pippin ...	Ditto ...	Ditto ...	1	...	
	Cox's Orange Pippin ...	Ditto ...	September 1903 ...	...	1	
	Ribston Pippin ..	Ditto ...	Ditto ...	...	1	
			July 1904 ...	...	1	
	King of Pippins ...	Ditto ...	September 1903 ...	...	1	
		Ditto ...	July 1904 ...	...	1	
		Locally grafted ...	Ditto 1906 ...	2	...	Planted under the wall.

STATEMENT—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Apple—*concld.*	Scarlet Golden Pippin ...	England ...	September 1903 ...	...	1	
			March 1903 ...	1	...	
	Thomas Rivers ...	Ditto ...	July 1904 ...	...	1	
	Allington Pippin ...	Ditto ...	Ditto ...	1	1	
	Braddick's Nonpareil ...	Ditto ...	Ditto ...	...	1	
	Mannington's Pearmain...	Ditto ...	Ditto ...	1	1	
	Devonshire Quarrenden...	Ditto ...	Ditto ...	...	1	
	Newton Pippin ...	Saharanpur ...	March 1903 ...	3	...	
	Blenheim Orange ...	Ditto ...	Ditto ...	2	...	
		Locally grafted ...	August 1908 ...	1	...	
	Early Harvest ...	Saharanpur ...	March 1903 ...	2	...	
		Locally grafted ...	January 1908 ...	1	...	

	Freeman's Apple ...	Old Model Farm ...	About 30 years old	...	4	Called Freeman's Apple after the name of the Superintendent of the Old Model Farm.
		Locally grafted ...	1898 ...	...	1	
	Ditto ditto ...	Ditto ...	1901 ...	...	5	
	White Apple ...	Ditto ...	March 1906 ...	1	...	
		Ditto ...	„ 1907 ...	3	...	
		Ditto ...	January 1908 ...	2	...	
		Ditto ...	February 1908 ...	2	...	
			Total ...	24	22	
	Souvenir du Congres ...	England ...	September 1903 ...	...	2	
	Beurre D'Amanlis ...	Ditto ...	March 1903 ...	1	...	
Pear ...		Ditto ...	September 1903 ...	...	1	
	Williams Bon Chretien...	Ditto ...	„ 1908 ...	1	...	
	Clapp's Favourite ...	Ditto ...	March 1910 ...	2	...	Transferred from Farm.

STATEMENT—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Pear—*contd.*	Doyenne du Comice	England	July 1904	1	...	
		Locally grafted	February 1908	1	...	
	Marie-Louise	Ditto	Ditto	2	1	
			March 1910	2	...	Transferred from Farm.
	Ditto	England	July 1904	1	...	
	Ditto	Locally grafted	February 1909	2	...	
	Duchesse D'Angouleme	England	July 1904	1	1	
	Conference	Ditto	Ditto	1	1	
		Locally grafted	March 1907	2	...	
		Ditto	February 1909	19	...	
	Louise Bonne of Jersey	England	July 1904	...	1	

	Ditto	March 1910	1			Transferred from Farm.
Emile D'Heyst	Locally grafted	Ditto	1			Ditto ditto.
	Ditto	Ditto 1908	3			
	Ditto	Ditto 1909	4			
	Saharanpur	Ditto 1903	3			
La Conte	Locally grafted	February 1908	3			
	Ditto	Ditto 1909	5			
	Saharanpur	March 1903	3			
China	Locally grafted	February 1909	2			
	Saharanpur	March 1903	3			
	Locally grafted	Ditto 1910	2			Ditto ditto.
Keiffer	Ditto	Ditto 1908	2			
	Ditto	Ditto 1909	16			
Kitchen Pear	Model Farm	30 years old			2	These have existed since the Old Model Farm.
Unknown Pear	Locally grafted	1905	2			
Rossenrhode's Pear	Ditto	February 1906	4			
Ditto	Ditto	September 1906	9			

STATEMENT—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Pear—*concld.*	Rosenrhode's Pear ...	Locally grafted ...	February 1907 ...	30	...	
	Ditto ...	Ditto ...	July 1907 ...	1	...	
	Ditto ...	Ditto ...	January 1908 ...	5	...	
	Ditto ...	Ditto ...	February 1908 ...	28	...	
	Ditto ...	Ditto ...	Ditto 1909 ...	27	...	
			Total ...	190	9	
	Mallard	England ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	1	...	

	Czar	Ditto ...	March 1903 ...		1	...		
	Ditto	Ditto ...	Ditto 1910 ...		2	...		Transferred from Farm.
	Cullins Golden Gage ...	Ditto ...	July 1904 ...		1	...		
	Ditto	Ditto ...	March 1910 ...		1	...		Ditto ditto.
	Jefferson	Ditto ...	July 1904 ...		1	...		
	Kirke's	Ditto ...	Ditto ...		1		1	
Plum ...	Golden Esperon ...	England ...	July 1909 ...		1		1	
	Monarch	Ditto ...	Ditto ...		1		1	
	Early Transparent Gage	Ditto ...	September 1903 ...	...			1	
	Swan	Ditto ...	July 1904 ...		1		1	
	Cox's Emperor ...	Ditto ...	Ditto ...		1		1	
	Belgian Peple ...	Ditto ...	September 1903 ...	...			1	
	Ditto	Ditto ...	July 1904 ...		1	...		
	Ditto	Locally grafted ...	January 1908 ...		1	...		
	Early Rivers ...	England ...	March 1903 ...		1	...		
	Ditto ...	Ditto ...	September 1903 ...	...			1	
	Ditto ...	Ditto ...	July 1904 ...		1	...		

STATEMENT—*continued*.

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at.		Remarks.
				Fruit Station.	Ij. m.	
1	2	3	4	5	6	7
	Early Rivers ...	Locally grafted ...	March 1906 ...	1	...	
	Ditto ...	*Ditto* ...	February 1909 ...	3	...	
	Ditto ...	Ditto ...	June 1908 ...	1	...	
	Belle de Louvain ...	England ...	September 1903 ...	...	1	
	Ditto ...	Ditto ...	July 1904 ...	1	...	
	Blue Rock ...	Ditto ...	September 1903 ...	...	1	
	Ditto ...	Ditto ...	July 1904 ...	...	1	
	Sultan ...	Ditto ...	September 1903 ...	...	1	
	Ditto ...	Ditto ...	July 1904 ...	...	1	
Plum—*contd.*	Victoria ...	Ditto ...	Ditto ...	...	1	
	Curlew ...	Ditto ...	Ditto ...	...	1	

	Greengage ...	Ditto ...	September 1903 ...	...		1	
	Reine Claude ...	Ditto ...	Septem' er 1903 ...	...		1	
	Ditto ...	Ditto ...	July 1904 ...	...		1	
	Unknown ...	Ditto ...	March 1903 ...	1	...		
	Ditto ...	Ditto ...	July 1904 ...	1		1	
	Ditto ...	Ditto ...	June 1908 ...	1	...		
	Denniston's Superb ...	Ditto ...	September 1903 ...	...		1	
			Total ...	26		20	
Nectarine ...	Cabul ...	Saharanpur ...	December 1907 ...	6	...		
	Ditto ...	Locally budded ...	February 1909 ...	2	...		
			Total ...	8	...		

STATEMENT—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	
Peach ...	Early Silver ...	England ...	March 1903 ...	2	...	
	Ditto ...	Ditto ...	September 1903 ...	...	1	
	Ditto ...	Locally grafted ...	1906 ...	1	...	
	Ditto ...	Ditto ...	February 1909 ...	5	...	
	Noblesse ...	England ...	March 1903 ...	1	...	
	Ditto ...	Locally grafted ...	February 1909 ...	2	...	
	Dr Hogg ...	England ...	March 1903 ...	2	...	
	Ditto ...	Locally grafted ...	1906 ...	1	...	
	Ditto ...	Ditto ...	February 1909 ...	6	...	
	Rivers' Early York ...	England ...	March 1903 ...	1	...	
	Ditto ...	Locally budded ...	1906 ...	1	...	
	Ditto ...	England ...	September 1903 ...	...	1	
	Ditto ...	Locally grafted ...	February 1909 ...	1	...	

	Royal George	...	England	...	September 1903	...	...	1
	China	...	Saharanpur	...	December 1907	...	1	...
	Duke of Wellington	...	Ditto	...	Ditto	...	1	...
	Early Rivers	...	Ditto	...	Ditto	...	1	...
					Total	...	26	3
	Common	...	Saharanpur	...	December 1907	...	2	...
Quince ...	Ditto	...	Ditto	...	January 1908	...	5	...
	Ditto	...	Locally layered	...	Ditto 1910	...	1	...
					Total	...	8	...
	Flemish Red	...	England	...	March 1903	...	1	1
	Ditto	...	Ditto	...	September 1903	...	...	...
	Early Rivers Black	...	Ditto	...	March 1903	...	...	1
	May Duke	...	Ditto	...	Ditto	...	1	...
Cherry ...	Ditto	...	Ditto	...	July 1904	...	1	...
	Royal Duke	...	Ditto	...	March 1903	...	1	...
	Ditto	...	Ditto	...	July 1904	...	1	...
	Ditto	...	Locally grafted	...	February 1909	...	1	...

STATEMENT—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper *Parin.*	
1	2	3	4	5	6	7
Cherry—*concld.*	Geante D'Hedelfingen ...	England ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	2	...	
	Kent Bigarreau ...	Ditto ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	1	...	
	Napoleon	Ditto ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	1	...	
	Black Eagle ...	Ditto ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	1	...	
	St. Margarets ...	Ditto ...	March 1903 ...	1	...	
	Ditto	Ditto ...	July 1904 ...	1	...	

	Ditto	Ditto ...	March 1910 ...	1	...		Transferred from Farm.
	Emperor Francis ...	Ditto ...	Ditto ...	1		1	
	Early Elton ...	Ditto ...	Ditto ...	1		1	
	Ditto	Ditto ...	September 1903 ...	2	...		
	Ditto	Ditto ...	March 1910 ...	1	...		Transferred from Farm.
	Cleve'and Bigarreau ...	Ditto ...	July 1904 ...	1	...		
	Guigne D'Winkler ...	Ditto ...	Ditto ...	2	...		
	Governor Wood ...	Ditto ...	Ditto ...	1		1	
	Black Tartarian ...	Eng'and ...	March 1910 ...	2	...		Transferred from Farm.
	Ditto	Ditto ...	July 1904 ...	1	...		
	Florence	Ditto ...	March 1910 ...	1	...		Transferred from Farm.
			Total ...	31		5	
Apricot ...	Royal	England ...	June 1903 ...	1	...		

STATEMENT—*continued.*

Species of fruit trees.	*Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Apricot—*concld*	Oullins Early Peach ...	England ...	June 1903 ...	1	...	
	Blenheim	England ...	September 1903 ...	...	1	
	New Large Early ...	Saharanpur ...	December 1907 ...	3	...	
	Cashmere	*Ditto* ...	Ditto ...	3	...	
			Total ...	8	1	

Almond ...	Amandier Communis ...	England ...	February 1904 ...	3	...
	Ditto	Ditto ...	March 1904 ...	...	1
	Thin Shell	Ditto ...	February 1904 ...	1	...
			Total ...	4	1
Walnut ...	Kashmir	Grown from seed ...	Summer 1905 ...	13	5
Fig ...	Brunswick	Local cuttings ...	July 1905 ...	3	...
	Ditto	Ditto ...	August 1905 ...	2	...
	Ditto	Ditto ...	September 1906 ...	1	...
	Ditto	Ditto ...	March 1907 ...	3	...
	Violette Sepor ...	Ditto ...	June 1906 ...	1	...
	Ditto	Ditto ...	September 1906 ...	3	...
	Ditto	Ditto ...	March 1907 ...	2	...
	Bourjasotte Noire ...	Ditto ...	September 1906 ...	1	...
	Bourjasotte Grise ...	Ditto ...	Ditto ...	1	...

STATEMENT—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5		7
	Figue d'Or ...	Local cuttings ...	August 1905 ...	1	...	
	Ditto	Ditto ...	June 1903 ...	...	1	
	Ditto	Ditto ...	September 1906 ...	1	...	
	Ditto ...	Ditto ...	March 1907 ...	1	...	
	Ditto	Ditto ...	February 1910 ...	1	...	
Fig—concld. ...	St. John	Ditto ...	September 1906 ...	3	...	
	Ditto	Ditto ...	March 1907 ...	1	...	
	Black Ischia ...	England ...	November 1903 ...	1	...	
	Ditto ...	Local cutting ...	March 1907 ...	1	...	
	White Marseilles ...	Ditto ...	August 1905 ...	1	...	
	Ditto ...	Ditto ...	September 1906 ...	2	...	

	Ditto ...	Ditto ...	March 1907 ...	1	...		
	Ditto ...	Ditto ...	„ 1908 ...	1	...		
	Brown Turkey ...	Local cuttings ...	August 1905 ...	3		2	
	Poona	Poona	March 1907 ...	4	...		
	Ditto ...	Local cuttings ...	February 1910 ...	2	...		
			Total ...	41		3	
	English, No. 1 ...	Local cutting ...	June 1904 ...	1		1	Nos. 1, 2, 3 and 5 name not known owing to loss of labels.
		England ...	March 1907 ...	1	...		
	„ No. 2 ...	Ditto	January 1908 ...	1	...		
		Local cutting ...	Ditto ...	1	...		
	„ No. 3 ...	England ...	July 1903 ...	1	...		
		Local cutting ...	March 1910 ...	1	...		Transferred from Farm.
Grape ...	„ No. 4 (Golden Queen).	England ...	January 1908 ...	1	...		
		Local cutting ...	1904 ...	1	...		
		Ditto ...	1905 ...	1	...		
		Ditto ...	January 1908 ...	2	...		
	„ No. 5 ...	Ditto ...	Ditto ...	3	...		
		England ...	March 1907 ...	1	...		
	...	Local cutting ...	March 1910 ...	4	...		Transferred from Farm.

STATEMENT—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm	
1	2	3	4	5		7
	English No. 6 (Lady Downe's seedling).	Local cuttings ...	January 1908 ...	1	...	
	Local Black ...	Local cutting from a vine in the Roman Catholic Mission compound.	1904	4	...	
	Ditto	Ditto ...	1905	1	...	
	Ditto	Ditto ...	1906	1	...	
	Ditto	Ditto ...	February 1907 ...	1	...	
	Ditto	Ditto ...	January 1908 ...	1	...	
	Ditto	Ditto ...	March 1910 ...	8	...	Transferred from Farm.
	Merlot	Cuttings obtained from Kashmir in 1903.	March 1906 ...	3	...	

Grape ...	Ditto	Ditto ...	February 1907 ...	13	...	
	Cabernet Sauvignon ...	Ditto ...	March 1906 ...	1	...	
	Ditto	Ditto ...	February 1907 ...	13	...	
	Malbeck wine ...	Ditto ...	March 1906 ...	2	...	
	Ditto	Ditto ...	February 1907 ...	5	...	
	Sanvignon Sautern ...	Ditto ...	March 1906 ...	2	...	
	Ditto ...	Ditto ...	February 1907 ...	14	...	
	Semiton Sautern ...	Ditto ...	March 1906 ...	3	...	
	Ditto ...	Ditto ...	February 1907 ...	10	...	
	Cabernet	Ditto ...	March 1906 ...	4	...	
	Ditto	Ditto ...	February 1907 ...	12	...	
	Hosseini Cabuli ...	Ditto ...	June 1906 ...	1	...	
	Chassellas	Ditto ...	February 1907 ...	9	...	
			Total ...	128	1	

STATEMENT—*continued.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4	5	6	7
Spanish Chestnut.	Spanish Chestnut ...	Legacy from former Model Farm about 30 years old.	.....	...	54	
	Ditto ...	Saharanpur ...	June 1903 ...	21	...	
			Total ...	21	54	
Cherimoyer ...	.....	From seed obtained from the Southern Shan States.	1904	5	...	
			1906	1	...	
			Total ...	6	...	
Tree Tomato ...	.....	From seed obtained from Ceylon.	July 1907	34	...	
			Total ...	34	...	

Mountain Papaya	.....	From seed obtained from Ceylon.	1906	6	...
			Total ...	6	...
Loquat ...	.....	From cuttings taken from trees in the Station.	1908	3	...
Guava ...	Smooth, green ...	Saharanpur ...	1905	1	...
	Ditto ...	Local layering ...	1907	1	...
	Cattleya	Saharanpur ...	1905	1	...
	Guinensis	Ditto ...	1905	1	...
			Total ...	4	...
Khasi Orange and Citron.	.....	Local	1904 & 1905 ...	112	...
Raspberry ...	White Antwerp ...	England, 1906 ...	March 1907 ...	5	...
	Bunyard Superlative ...	Ditto ...	Ditto ...	3	...
	Hybrid	Public Garden, Pachmarhi, C. P.	March 1910 ...	4	...
			Total ...	12	...

STATEMENT—*concluded.*

Species of fruit trees.	Variety.	Whence obtained.	When planted.	Number planted at		* Remarks.
				Fruit Station.	Upper Farm.	
1	2	3	4		6.	7
Gooseberry ...	White Smith ...	England ...	September 1903 ...	...	1	
	Hedgehog ...	Ditto ...	July 1904 ...	...	1	
			Total ...	...	2	
Currant ...	Red Scoe	Ditto ...	September 1903 ...	...	2	
	Boskop, Black ...	Ditto ...	September 1903 ...	...	1	
	Ditto	Ditto ...	July 1904 ...	...	2	
	White Versaillaise ...	Ditto ...	September 1903 ...	...	1	
	Ditto	Ditto ...	July 1904 ...	1	...	
	Ditto	Ditto ...	March 1907 ...	5	...	
			Total ...	6	6	

ANNUAL REPORT OF THE UPPER SHILLONG AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1910.

Introductory.

Since 1903, this farm has been managed as a joint concern with the Fruit Experiment Station. The main work at the Fruit Garden is the cultivation of fruit trees imported from the temperate climates of Europe. Part of this work is carried on at the Upper Shillong station and is dealt with in the report on the Fruit Garden.

History and description.

2. The Upper Shillong Station was established in the year 1897-1898. It is situated on the Cherrapunji road 5½ miles from the town of Shillong, and occupies the site of the old Model Farm which ceased to exist in 1879. The elevation of the station is 5,900 ft., *i.e.*, about 900 ft. higher than Shillong town. A detailed survey of the Farm was made during the year by the Provincial Survey Party. A large area of pine forest was annexed to the station in 1905. The total area of the Farm, inclusive of the forest, is 336·67 acres. All the fields but two lie on the slope of a long, narrow valley, the bottom of which consists for the most part of marshy land, covered with a thick growth of wild grass. A considerable area of land has been reclaimed by deepening and straightening the stream which drains the valley and cutting side *nullahs* which connect with it. A great deal of work in these directions was done during the year under report. Soft boggy land on which it was unsafe to walk at one time has been converted by this means into firm pasture ground, and the character of the herbage has at the same time shown a marked change for the better. The forest is of use as a source of timber, a large quantity of which is annually required for fencing and building on the station.

The soil of the greater part of the station is a coarse reddish loam of very loose texture which can be worked with the greatest ease. The sub-soil is of a more pronounced reddish colour and of great depth. In a small portion of the station the soil is black owing, it is believed, to the existence of some mineral compound. The soils have not been analysed. In point of quality, they are extremely poor and very little

can be grown on them without the help of manure. The soil at the bottom of the valley is very different from either of the above. It is a clay or clayey loam, extremely rich in organic matter. Having been under a thick growth of grass for many years, the upper portion of the soil is a matted mass of half-decayed grass roots. None of this soil has been brought into cultivation.

Besides the natural poverty of the soil the greater portion of the station suffers from the disadvantages of an exposed situation. It is colder and more windy than Shillong; frosts are of very common occurrence during the winter and more severe than in the town. During the winter the growth of vegetation is wholly suspended.

The main objects with which the station was established were the introduction of superior varieties of potato, which is the most important staple grown on the higher plateau of the Khasi Hills, the cultivation of fodder crops and the preservation of fodder in silos for use in the winter when natural fodder becomes extremely scarce, and the encouragement of fruit cultivation. These objects are still kept in view. Another important item of work is the breeding of improved strains of cattle with a view to their introduction in the district.

Weather.

3. The weather on the whole proved very unfavourable In October and November it was unusually wet and interfered very seriously with the making of hay. The spring rains began early and helped in the germination of the potato crop, but all through April and part of May the weather proved abnormally wet and brought on an early and severe attack of blight which killed the crop long before it was due.

Work done during the year.

4. This includes—

(1) Potato Experiments.
(2) Cultivation of potato for seed.
(3) Trials of oats.
(4) Trials of clovers and grasses.
(5) Trials of other new crops—flax, New Zealand flax and Chinese soy bean.
(6) Growing of fodder crops for silage and hay.
(7) Cattle breeding.

(8) Sheep breeding.

(9) Demonstrations on cultivator's holdings.

Potato experiments.

5. These are very nearly the same as in the preceding year, *viz.* :—

(1) Variety tests.

(2) Manurial trials.

(3) Spraying with Bordeaux Mixture.

(4) Whole *versus* cut sets.

(5) Methods of planting.

(6) Sprouted *versus* unsprouted sets.

Variety test.

6. The following eight varieties were tested against each other; against the foreign varieties is noted the source from which the original stock of seed was received, and the year since which it has been cultivated in the farm :—

Khasi Round, obtained locally in 1910.

Khasi Nainital ditto.

King of Potatoes, England, 1906.

King Edward VII ditto.

Sutton's Magnum Bonum, England, 1908.

Windsor Castle, England, 1909.

British Queen ditto.

Up to date ditto.

All these varieties had been tested in the preceding year. Four other varieties tested in that year were excluded from the experiment under report. Two of them, namely, the old stock of Farm Magnum Bonum and Nainital from stock imported in 1908 had proved to be poor yielders; and two others, namely, Earliest of All and Northern Star, failed completely in the winter and consequently no seed was available for continuing their cultivation.

The seed of each variety used in the experiment was the produce of the preceding winter crop. The experimental crop was planted during the last week of February and manured with 300 mds. of cowdung and 10 mds. of oil-cake per acre. The seed rate was 10 mds. per acre in each case.

The crop was sprayed twice during the season, the dates of spraying being 29th April and 17th May. Owing to the unusually wet nature of the season, the crop in this as well as in every other experiment got blighted as early as the middle of May and by the beginning of June the plants had lost every leaf and been reduced to mere stems. The yields were in consequence greatly reduced. The experiment was made in two series. Six of the varieties occupied $\frac{1}{20}$th of an acre in each series; one (British Queen) was represented in only one series and could not be duplicated for want of seed. The eighth variety, Up to date, had almost failed in the winter and gave seed enough to plant only $\frac{1}{80}$th of an acre. The yield of each of these eight varieties is shown in the following table:—

No.	Variety.	Series I.			Series II.			Average yield of two series per acre.
		Area planted in acres.	Actual yield.	Yield per acre.	Area planted in acres.	Actual yield.	Yield per acre.	
1	2	3	4	5	6	7	8	9
			Mds. Srs.	Mds. Srs.		Mds. Srs.	Mds. Srs.	Mds. Srs.
1	Khasi Round ...	$\frac{1}{20}$	4 33½	96 30	$\frac{1}{20}$	4 29	94 20	95 25
2	Khasi Nainital ...	$\frac{1}{20}$	6 28	134 0	$\frac{1}{20}$	5 8	104 0	119 0
3	King of Potatoes ...	$\frac{1}{20}$	6 6½	122 10	$\frac{1}{20}$	7 1½	140 30	131 20
4	King Edward VII ...	$\frac{1}{20}$	4 19½	88 10	$\frac{1}{20}$	3 21½	70 30	78 20
5	Magnum Bonum (Sutton's, 1908).	$\frac{1}{20}$	6 10	125 0	$\frac{1}{20}$	7 0	140 0	132 20
6	Windsor Castle ...	$\frac{1}{20}$	3 31	75 20	$\frac{1}{20}$	2½	51 10	63 15
7	British Queen ...	$\frac{1}{20}$	4 25½	92 30	...	...	...	92 30
8	Up to date ...	$\frac{1}{80}$	1 5	93 0	...	...	...	90 0

The three varieties which came out best were Magnum Bonum, King of Potatoes and Khasi Nainital. Khasi Nainital headed the list in one series, but gave less yield in the duplicate trial, and hence compares somewhat unfavourably with Magnum Bonum and King of Potatoes.

Nevertheless, I consider these three varieties to be of about equal merit. The original stock of Khasi Nainital came from the Nainital Hills where the variety had been introduced from England, and is identical with the English Magnum Bonum; and there is no material difference between the latter and the King of potatoes, except that in the latter the eyes are larger and more prominent than in the case of Magnum Bonum, and the tubers lie near the surface of the ground. All the three varieties belong to the kidney class and produce long oval, slightly flattened tubers with creamy-white skin and white flesh. Since the inception of the farm in 1908, a large number of foreign varieties of potato have been tried; most of these proved to be poor yielders and were rejected from time to time. The only varieties which have continued almost uniformly to maintain their superiority are Magnum Bonum and varieties which are identical with or are closely allied to it.

Khasi Round proved less prolific than the three kinds mentioned above. In 1908-1909 it had proved almost equal to them in point of yield. This variety was introduced by Mr. David Scott in the early part of the last century, and though it has been largely superseded by the Nainital potato, it still continues to be a favourite with the Khasia cultivators.

King Edward VII has been grown on the Farm since 1906. In 1907, it proved to be equal to King of Potatoes in point of yield, but since then it has been gradually falling behind, and during the year under report it gave a very poor yield. It is a fine looking potato with very white mealy flesh; the skin is white but mottled with patches of red which give the tuber a characteristic appearance.

Windsor Castle has proved to be the worst in respect of yield. This variety had been tested some years ago on the Farm, but proved unsatisfactory in point of yield. It was introduced again in 1909 and has again turned out to be a poor yielder.

The prospects of British Queen and Up to date are uncertain. The latter gave a most encouraging result in 1909, but has given a disappointing yield this year.

To get some idea as to the proportion of diseased tubers at harvest time, 50 large tubers of each variety were taken aphazard, cut open and examined for signs of disease.

The results were as follows:—

No.	Variety.	Out of 50 large tubers.	
		Number of sound tubers.	Number of diseased tubers.
1	2	3	4
1	Khasi Round	48	2
2	Khasi Nainital	26	24
3	King of Potatoes	44	6
4	King Edward VII	41	9
5	Magnum Bonum (Sutton's, 1908) ...	47	3
6	Windsor Castle	42	8
7	British Queen	44	6
8	Up to date	43	7

None of the eight varieties proved wholly sound. Khasi Round and Magnum Bonum proved the healthiest of all, and Khasi Nainital worst of all as regards disease. Some years ago, the Khasi Round variety which was then the only kind grown in the Khasi Hills was so badly diseased as to be threatened with extinction, and the Nainital variety was introduced as being more prolific and a better resister of disease than the native stock which it has largely replaced within the last decade. It is strange that the Nainital has in its turn become a victim to disease while the older variety seems to be getting more immune.

The experience at Upper Shillong has abundantly shown that no newly introduced variety of potato can remain absolutely immune against the disease for more than a year or two, every new variety that has been introduced having shown an increasing proportion of disease from year to year. There is no hope, therefore, of our being able to find a variety which will always remain wholly free from

disease. Our aim should be to find by comparative trial one or more varieties which we can put forward as being superior to the native potatoes in respect of yield and quality; once we have succeeded in hitting upon such a new variety, it should be propagated on a business scale for the purpose of sale as seed to the Khasi growers. At the same time fresh seed of the selected variety should be obtained annually or every two years in order to prevent the stock from getting over-diseased by continuous cultivation without change of seed.

In Magnum Bonum and King of Potatoes we have found two new varieties which are better on the whole than the indigenous Khasi Round. It is proposed, therefore, to grow these varieties on a large scale for the purpose of dissemination. A portion of the last crop will be available for distribution among Khasia potato growers this year.

Manurial and spraying trials.

7. These two experiments were combined in the same plots and made on the same lines as in the preceding year. Twenty $\frac{1}{40}$ acre plots arranged in four series of 5 plots each were taken and all were dressed with 150 maunds of cowdung per acre. Then in addition :—

4 plots received 10 maunds of rape cake per acre.

4 „ „ 20 „ „ „

4 „ „ 150 „ cowdung „

4 „ „ 150 „ „ „ and
10 „ rape cake „

4 „ nothing in addition.

Magnum Bonum potatoes were planted on all the plots in the last week of February, and the crop was harvested in July.

The spraying experiment was carried out on the same plots, half of each of the 20 plots, being sprayed twice with a total of 240 gallons of Bordeaux Mixture per acre, and the other half being left unsprayed. The dates of spraying were 28th April and 4th June. For want of fine weather the second spraying was delayed too long, and neither spraying could have much effect owing to constant rain during the season.

The results of the combined experiment are exhibited below, the total of the four series being given against each description of manure used.

Serial No.	Manure used in addition to 150 maunds of cowdung per acre.	Sprayed		Unsprayed.		Average of sprayed and unsprayed per acre.
		Actual yield from ½ acre.	Yield per acre.	Actual yield from ½ acre.	Yield per acre.	
1	2	3	4	5	6	7
		Mds Srs.	Mds. Srs	Mds. Srs.	Mds. Srs.	Mds. Srs.
1	Rape cake, 10 maunds ...	6 14	107 0	5 13	106 0	106 20
2	Rape cake, 20 maunds. ...	7 11	145 20	6 26	133 0	139 10
3	Cowdung, 150 maunds ...	4 0	80 0	3 37	78 20	79 10
4	Cowdung, 150 maunds, and rape cake, 10 maunds.	6 14	127 0	5 27	113 20	120 10
5	Nothing	2 31/5	65 20	2 21	50 20	58 5
	Total ...	25 30½	103 2	24 3	96 12	.....

Taking the manurial trials first, it will be seen by comparing with No. 5 that the addition of 10 maunds of rape cake (No. 1) which cost about Rs. 32-8-0 per acre raised the yield from 53⅘th to 106½ maunds. The increase (53⅗ maunds) obtained might be valued at Rs. 80 (at Re. 1-8-0 per* maund) and would leave a handsome margin of profit after deducting the cost of the cake. The usefulness of rape cake as a manure for the potato crop had been proved over and over again in the earlier years of the Farm and has received additional confirmation from the present experiment. By increasing the dose of oil-cake from 10 maunds (No. 1) to 20 maunds (No. 2) the yield was enhanced in the sprayed series by 38½ maunds and in the unsprayed series by 27 maunds. In both cases the increase resulting from the additional manure left an appreciable

* As a matter of fact, the price of potatoes this year at harvest time averaged over Re. 1-12-0 per maund.

net profit, though in accordance with the Law of Diminishing Returns, it was less than in the case when only 10 maunds of oil-cake was used. It will also be seen, on comparing No. 1 and No. 3 with No. 5 that while the addition of 10 maunds rape cake raised the yield by 5$\frac{3}{5}$th maunds, the increase which followed on the addition of 150 maunds of cowdung amounted only to 26$\frac{1}{5}$th maunds. The balance in favour of oil-cake amounted to 27$\frac{1}{4}$th maunds valued at about Rs. 41 which would be a few rupees in excess of the cost of the manure (at Rs. 3-4-0 per maund). Where, therefore, cowdung is available in plenty and costs nothing, not much advantage will be gained by using oil-cake. On the other hand, when the supply of the natural manure is limited, it will pay well to supplement it by oil-cake.

As regards the spraying trials, it will be seen that the use of Bordeaux Mixture gave only a nominal increase in every one of the five differently manured plots. Constant rain prevented the mixure from exercising its effect as a preventive of disease, and both the sprayed and unsprayed areas appeared to be equally diseased. The spraying trials failed, therefore, to produce any result this year.

Whole *versus* cut sets and sprouted *versus* unsprouted sets.

8. These two experiments were combined in the same plots. There were eight of these, each $\frac{1}{10}$th of an acre, arranged in two series of four plots. The four plots in each series were planted as below :—

(1) With sprouted whole sets ;

(2) With unsprouted whole sets ;

(3) With sprouted cut sets ;

(4) With unsprouted cut sets.

The cut sets were obtained from large tubers, each being cut into two ; the whole sets were medium sized tubers. Care was taken to use the same weight (9 maunds) and the same number (25,600) of sets per acre for all the plots. It follows, therefore, that the average size of the tubers used for cut sets, which were divided each into two pieces, was twice as large as the medium sized tubers that were used as whole sets.

The sprouted and unsprouted sets were obtained from one and the same lot of potatoes. The tubers which were destined for use as "sprouted sets" were kept thinly spread on sand, and had produced sprouts between an eighth and a quarter of an inch long before they were taken out

for planting. The tubers intended for use as "unsprouted sets" were kept heaped in a corner of the house and showed signs of sprouting at the time of planting.

Khasi Nainital was the variety used in the experiment. The plots were all manured with 300 maunds of cowdung and 10 maunds of rape cake per acre. The crop was planted in the middle of March and harvested in July. The results of the combined experiment are set forth in the following table :—

Serial No.	Kind of sets used.	Area planted.	Actual yield.	Yield per acre.
1	2	3	4	5
		Acre.	Mds. Srs.	Mds. Srs.
	Series I.			
1	Sprouted whole	1/16	5 8½	83 16
2	Unsprouted whole	1/16	5 6½	82 24
3	Sprouted cut	1/16	8 6	130 16
4	Unsprouted cut	1/16	7 8	115 8
	Series II.			
1	Sprouted whole	1/16	6 20½	104 8
2	Unsprouted whole	1/16	6 18½	103 16
3	Sprouted cut	1/16	7 26	122 16
4	Unsprouted cut	1/16	7 11	116 16
	For both series.			
	Whole sets	¼	23 14	93 16
	Cut sets	½	30 11	121 4
	Sprouted sets	½	27 21	110 4
	Unsprouted sets	½	26 14	105 16

So far as whole *versus* cut sets were concerned, the experiment appears to have given a decisive result in favour of cut sets. This will be seen in case of both sprouted sets and unsprouted sets and in both series. The increased yield from cut sets may be accounted for on the ground that

sets obtained by dividing larger tubers which are presumably more fully mature should be more productive than smaller tubers used as whole sets, many of which must have been harvested before they had attained full growth. This experiment had been made in the past two years; in the first year (1908) it gave a negative result, and in the second (1909) it showed a slight excess in favour of cut sets.

Coming now to sprouted against unsprouted sets, the former will be seen to have produced a small increase in yield in every case. The same was the case in 1909. The increase obtained from sprouted sets was not sufficiently great to justify the cost and trouble involved in getting the sets to sprout.

Methods of planting.

9. This experiment was made for the second time last season. The local method of planting potatoes is in flat beds, about 7 feet wide with furrows for drainage between every two beds; the tubers are planted in holes $1\frac{1}{2}$ feet apart; the manure is placed on the top of the sets and the whole is then covered with the soil taken out of the holes. Each plant is earthed separately. This method was compared with the ordinary method of planting in drills on the top of the manure and earthing the plants in rows, the field eventually taking the form of alternate ridges and furrows. The experiment was carried out in four different series, each consisting of two plots of $\frac{1}{20}$th of an acre each. Khasi Nainital was the variety used. All the plots were planted on the same day with 10 maunds of seed per acre and manured with cowdung and rape cake at the rates of 300 maunds and 10 maunds per acre, respectively. The yields of tubers were as follows:—

No.	Method of planting.	Series I.	Series II.	Series III.	Series IV.	Total of 4 series.	
		Per plot.	Per plot.	Per plot.	Per plot.	Four plots.	Per acre.
1	2	3	4	5	6	7	8
		Mds. Srs.	Mds. Srs.	Mds. Srs.	Mds. Srs.	Mds. Srs.	Mds. Srs.
1	Local	6 28	8 28½	8 22½	5 32½	29 26½	148 13½
2	Ordinary ...	3 26½	4 27	3 20½	2 19	13 13	61 25

In the experiment of 1909 both methods gave about the same yields, but during the year under report the results were decisively in favour of the local method of planting. In the ordinary method of planting, the sets took long to germinate and the crop remained backward. There seems to be an advantage in placing the manure, as in the local method, on the top of the sets as it helps the soil to retain moisture and this hastens the process of germination. In the ordinary method, the land being laid out in numerous ridges and furrows is exposed to greater evaporation of moisture as well as to greater wash from rain than the flat beds made in the local method. It is desirable, however, not to draw any definite conclusions until the experiment has been repeated for a year or two longer.

Cultivation of potatoes for seed.

10. Two distinct methods of growing potatoes are practised in the Khasi Hills. One may be called the garden system and the other the *jhum* system of cultivation. In the garden system, the same land is cultivated with potatoes year after year and the crop is invariably manured with cowdung. On the Upper Shillong Farm a modified system of garden cultivation is followed: the crop is grown on old cultivated land, though the site is changed from year to year, and it is liberally manured with cattle dung. In the *jhum* system, new waste land is used every year and not more than one crop of potatoes is taken during the two or three years that it remains under cultivation. The land is prepared by a process of paring and burning. Large quantities of brush wood consisting of pine twigs, ferns and other jungle growth are used to help in the burning of the turf. The brushwood is arranged in long narrow parallel beds, 4 to 6 feet wide, leaving open intervals of about the same width between them. When the wood is dry, the turf is pared off the intervening ground and laid over the wood, and the whole is then set on fire. In the mixture of burnt earth and ashes thus obtained the potato sets are planted in the usual way. No other manure is used. The garden system yields larger tubers and much heavier outturns than the *jhum* system, but in the latter the tubers, though smaller, are firmer in texture, more free from disease, and keep better than those obtained from garden cultivation. For this reason the Khasias prefer *jhum* grown potatoes for use as seed.

Our practice hitherto has been to obtain Nainital seed potatoes for supplying applicants in the plains mostly from

the Calcutta market which derives its supply from the Nainital Hills. There is reason to believe that Nainital seed grown in the Khasi Hills, though somewhat diseased, is not inferior in quality to seed obtained from the Nainital Hills. Last year (October 1909) we supplied 50 maunds of Khasi Nainital seed potatoes to the Bengal Agricultural Department who have reported favourably on the quality of the seed. It was decided, therefore, that instead of obtaining our supply of Nainital seed from Calcutta this year, we should grow a sufficient quantity of seed in the Upper Shillong Farm for the purpose of distribution in the plains; and if the plan succeeds, we should follow it in future. In accordance with this decision, 4·83 acres of land were prepared and planted with potatoes under the *jhum* system of cultivation. The crop was sown in March and harvested in August. It was sprayed once with Bordeaux Mixture.

The total yield of potatoes amounted to 202 mds 22 seers, equivalent to about 42 mds per acre. On one plot of 1·14 acres the yield came to 94 mds per acre and on another of ·44 acre to 76½ mds per acre. On the remainder of the area the crop gave an extremely low outturn which depressed the average for the whole area. Portions of the *jhum* did not burn properly and the crop suffered more than usual from disease. These causes account for the low average yield. On examining potatoes taken from different parts of the area, 15 to 20 per cent. of the larger ones showed slight traces of infection from the potatoe blight; but medium and small tubers appeared to be almost free from signs of the disease.

These potatoes are destined for issue as seed to applicants in the plains. They are not wholly free from disease, but if care be taken to cut the larger tubers and discard all those which reveal any discolouration in the flesh, the risk of failure from disease may be minimised. The smaller tubers may be sown whole.

Oats.

11. Two sowings of this crop were made during the year, one in September 1909 and the other in April 1910. The autumn crop which occupied 1⅘th acres germinated well, but about ⅔ths of it was killed by frost; the remainder which survived the winter started into fresh growth on the arrival of warm weather in spring and was harvested in the beginning of May last. The yield was very poor, being only about 1 maund of grain. The autumn sowing must be considered a failure.

The spring sown crop occupied one-fifth of an acre and came up well. It was harvested in August and gave a yield of .

Clovers and grasses.

12. Mention was made in paragraph 12 of the last Annual Report that several species of English clovers and rye grasses were sown in November 1908, but that all the clovers had died out and though the rye grasses still remained, they were stunted in growth and seemed unable to hold their own against the indigenous grasses. These grasses have kept on growing and have produced some seed, but it has become abundantly clear that unless they are kept constantly weeded, they will be soon crowded out by the native grasses.

Two species of Japanese clover, *Astragalus sinicus* and *Lespedeza striata* were tried during the year. Two sowings of each were made, one on 3rd September 1909 and the other on 11th April 1910. The trials were made in very small plots of a few square yards each. *Astragalus sinicus* sown in the autumn continued to grow right through the winter and after flowering and seeding in the spring, it gradually died out. The growth was stunted and scanty, though in all appearance quite healthy. The spring-sown crop is now in the ground: it looks healthy, but being stunted it is not expected to produce much herbage. A small quantity of seed has been obtained from the autumn-sown crop for sowing in the present autumn in order to see if the acclimatised seed will produce a better crop. The other species of clover (*Lespedeza striata*) has practically failed. The autumn-sown crop was killed out by frost; and in the spring sowing, the germination was poor and the few plants that have come up look stunted in growth but quite healthy.

Mention was made in the last Annual Report of two of the best local wild grasses which were planted from roots collected from the jungle. One of the two grasses, *Langtylli*, has grown very well and formed good clumps. It was mown once in July last and gave 12 maunds of succulent fodder. A second cutting will be taken next month and ensiled for winter use. The other grass, *U Proot*, died off, but has been replanted this year; its looks unpromising. The two grasses occupy an area of about $\frac{5}{8}$ths of an acre.

A new fodder grass, *Euchlæna mexicana, Schrad*, is now under trial. It occupies a plot measuring one-twentieth of an acre. The land was manured with cowdung at the rate of 150 maunds per acre, and sown broadcast with one seer of

seed on 7th May last. The crop has come up well and formed good strong-looking clumps which promise well.

Three pounds of *Dhaman* grass seed was received from the Officer Commanding the Assam District, with request to try it at Upper Shillong. The seed was sown on a piece of land measuring three-twentieths of an acre in the middle of May 1910. It germinated very poorly, and has produced a small number of plants, some of which are now in flower. The prospects of the grass are very doubtful.

Trials of other new crops.

13. *Flax.*—A series of experiments with this crop was started last autumn at the instance of the Fibre Expert, the object being to see how the crop thrives on the Shillong plateau and if it will produce good seed. Two experimental sowings were made during the year, one in October 1909 and the other in March last. The autumn-sown crop came up well, but did not get time enough to establish itself before the frost arrived and killed it. The spring sowing grew very well and produced stems about three feet long, but as it ripened in the middle of the rains, it was found impossible to dry the straw properly, and the seed got soaked and burst in the pods before it could be threshed out. It will be no use trying to raise flax either for fibre or for seed in the rains. The only prospect of success lies in sowing the crop in the latter part of the rains, so as to get it in during the early part of winter or about May. To test this possibility, arrangements have been made to sow a small area of flax in August and a second time again in September. The August sowing has been already made.

New Zealand flax—Three dozen plants of this new fibre crop were received from New Zealand in June 1908. Nineteen of these were planted in this farm and seventeen in the Fruit Station at Um Lyngka. The plants looked almost dead when they arrived, and all of them succumbed except three at the Fruit Station which survived. These three plants are growing well and one of them has formed a fairly big clump. During the winter the plant dies down to the roots, but throws up new shoots on the arrival of spring.

Chinese soy bean.—A few ounces of acclimatised Chinese soy bean was obtained from Dr. Mann, Principal of the Poona College of Agriculture. Seed of ten different varieties, was obtained and sown in May along with the Khasi soy bean (*Rymbai ktung*) for comparison. The Poona seeds

germinated very poorly, and the plants suffered more from the invasion of small beetles. Most of the plants have flowered and formed pods, in this respect showing a much earlier maturity than the country variety which has not yet come to flower. The seed will be saved for trial next year.

Fodder crops for silage and hay.

14. During the year, maize, Job's tears and two species of millet called *Baishan* (*Paspalum sanguinale*) and *Raitruh* (known elsewhere as *marua*) were grown for fodder. Job's tears and maize were cut green and ensiled, while the millet crops were turned into hay. The details of area sown, cost of cultivation and outturn were as below :—

No.	Crop.	Area.	Cost of cultivation.	Yield of green fodder.	Yield of hay.
1	2	3	4	5	6
		Acre.	Rs. a. p.	Mds. Srs.	Mds. Srs.
1	Job's tears	1·09	27 15 6	304 2	.....
2	Maize	1·25	59 1 0	390 8	.....
3	*Baishan*	6·75	246 7 0	.....	275 12
4	*Raitruh*	1·58		.....	54 30

Taking the two millets together, the yield of hay amounted to about 40 maunds per acre, and the cost came to about 12 annas per maund. Too much rain in October and November interfered seriously with the drying of the grass which got repeatedly wet and lost greatly in quality. As it was, the crop could not be mown till about the middle of October after it had matured its seed and become more or less coarse. These causes combined to reduce the quality of the hay; the farm cattle seemed, however, to eat it with relish.

During the year silage was made in four silos of which one, a semi-circular masonry silo, which had been constructed in the previous year at a cost of Rs. 623-9-2, was used for the first time last year, and three (two box and one pit) were old silos which had been used for many years. The silos were filled one after another from the end of July to the

middle of September. The fodder used was Job's tears and maize grown on the farm and grass brought from a part of the grazing area from which cattle had been kept out. The total quantity of fodder ensiled was 1,320 maunds 18 seers, out of which 659 maunds 23 seers or just 50 per cent. was recovered as good silage and fed to the farm stock from January to April; the remainder represented loss through rottage and dryage. The loss through these causes was very heavy in the box silos which were old and leaked badly. The silage made in the pukka silo was the best in point of quality and outturn, as much as 72 per cent. of the total fodder put in having been recovered in the best possible condition. If this silo had been circular instead of semi-circular shape, much of the rottage which took place mostly at the corners could have been avoided. The silo suffered also from the existence of a door about half way up the circular wall. The fodder which was placed next to this door could not be pressed tight enough to exclude air, and consequently suffered from excessive rottage. But for these two defects, the proportion of good silage obtained from this silo might have been still higher. It is proposed to remove these defects next year.

The total cost of the 659 maunds 23 seers of silage actually obtained was Rs. 310-0-7 which included the cost of growing the fodder crops as well as the cost of collecting the wild grass. The cost came, therefore, to seven annas six pies per maund.

Cattle breeding.

15. The following table shows the number of cattle on the farm on the 30th June 1910:—

—	Patna.	Bhutia.	Patna × Bhutia.	Patna × Patna — Bhutia.	Khasi.	Patna × Khasi.	Patna × Patna — Khasi.	Total.
1	2	3	4	5	6	7	8	9
Bulls	2	...	...	...	...	...	...	2
Cows	10	2	2	...	1	6	...	21
Heifers	4	4	8	1	...	4	...	16
Young bulls	8	...	1	..	...	13	5	27
Heifer calves	1	...	1	...	...	2	...	4
Bull calves	7	...	...	...	..	...	3	10
Total	32	6	7	1	1	25	8	80

Besides there were two Hindustani and six Synteng plough bullocks. The total number of cattle on the farm was, therefore, 88. Seven animals were purchased during the year, namely, four Bhutia heifers from the Udalguri fair in Mangaldai at a cost of Rs. 153-4-6 (including cost of transport) and three Synteng plough bullocks which cost Rs. 124-12-0. The new Bhutia animals are different to the old stock of Bhutia cows and look rather unpromising. At the advice of the Superintendent of the Civil Veterinary Department as many as 31 animals, consisting of old Khasia cows and some cross-bred and in-bred stock, were disposed of by sale, at an aggregate price of Rs. 774-2-0. Nineteen animals were born, and five including a Patna cow imported in 1908 died during the year.

We have made it a rule not to issue any bulls from the farm until they are three years old. No young bull was issued during the year as none had attained this age. Three young bulls have since become available for issue.

One of the two Patna bulls named "Taylor" has been kept at the Fruit Garden since December 1908 in order to serve cows belonging to cultivators of the neighbouring villages. This bull was imported in 1902 and has become old and somewhat indolent. The villagers complain that he is too heavy for most of their cows, and are unwilling to bring in cows to him for service. He was however allowed to graze with the village herds and is known to have served a few cows. The up-keep of this bull costs about Rs. 16 per month and I doubt very much if the service obtained from him now is at all commensurate with the money spent on his maintenance.

Mr. Harris, Superintendent of the Civil Veterinary Department, has been taking a keen interest in the cattle breeding operations on the farm and helping us with advice in matters requiring professional knowledge. The Veterinary Assistant at Shillong paid occasional visits to the farm to watch the health of the cattle and give advice in case of sickness.

For some time past, our practice has been to milk the cows sparingly and allow the calves to take a much larger share of milk than they would ordinarily get. During the winter months, milking was entirely stopped. This enabled the calves to tide through the winter tolerably well. The older stock, however, fell off in condition in winter in spite of all the money we spent in feeding them at home. It has

become clear that without an unduly lavish expenditure for fodder it will be impossible to maintain cattle at Upper Shillong in good condition during the winter when there is absolutely no grazing to be had. Arrangements are therefore being made to open a subsidiary grazing farm at a lower elevation where pasturage will be available during the winter months. A site has been selected for the purpose, and we expect to send down the herd to the new place early next winter and keep it there till spring.

The total cost of maintaining the herd (including the sheep) during the year was Rs. 5,607-11-11. The details were as follows :—

	1909-10. Rs.	a.	p.
Purchased food (oil cake, matikalai, salt, grass and rice)	3,579	11	8
Value of farm produce (silage, potatoes, sweet potatoes)	1,032	3	6
Wages of cowmen...	995	12	9
Total	5,607	11	11

The total outturn of milk during the year amounted to 9,553 lbs. which was sold for Rs. 597-1-0.

Sheep breeding.

16. It was mentioned in the last Annual Report that an experiment had been initiated in the farm in crossing native ewes with a Dumba ram. The experiment started with one Dumba ram and five Khasi ewes purchased in February 1909. Three of the ewes dropped lambs shortly after their arrival. All the ewes mated freely with the Dumba ram. By the 30th June 1910, the flock had increased to a total of 15 sheep, namely, one Dumba ram, 6 Khasi ewes, and 8 cross-bred lambs of which five were males and three females. Besides these 15, two Khasi lambs were sold; one cross-bred lamb was killed by a jackal and another strayed into the jungle and was lost. The cross-bred sheep exhibit a decided improvement on the native stock. The experiment seems full of promise.

Receipts and expenditure.

17. The total receipts for the year amounted to Rs. 1,455-11-5 and the expenditure to Rs. 13,593-8-10 including Rs. 2,111-12-7 for establishment and Rs. 316-4-0 for capital charges. These figures include the receipts and expenditure of the Fruit Garden at UmLyngka.

Establishment.

18. The establishment which is common to the Farm and Fruit Garden consists of one Superintendent, one clerk, one overseer, one mali (for the Fruit Garden) and two temporary fieldmen whose duties are concerned solely with the numerous demonstrations which have been organised in the interior of the district. It was found necessary in the course of the year to replace the former Khasi clerk by a Bengali in order to extricate the accounts and books from the state of confusion into which they had fallen.

Demonstrations.

19. A supplementary note is printed as an Appendix.

SHILLONG;
The 19th August 1910.

B. C. BASU,
Deputy Director of Agriculture.

APPENDIX.

AGRICULTURAL DEMONSTRATIONS IN THE KHASI HILLS FOR THE YEAR ENDING THE 30TH JUNE 1910.

Introductory.

The work of demonstrating certain agricultural improvements on cultivators' holdings in the Khasi Hills was continued during the year on a somewhat larger scale than in the previous year. The services of two temporary Khasi fieldmen to conduct the demonstrations have been engaged for the purpose. They are paid Rs. 25 each per mensem. The sanction for these two appointments expires on the 31st December 1910. The duty of organising the demonstrations and supervising the work of the fieldmen rested with Mr. Herrick Singh, Superintendent of the Experimental Farms, Khasi Hills. Being engaged in many other duties, he was not able to give as much time and attention to this work as he liked to give. The demonstrations were scattered over a large area, and if the Farm Superintendent had been able to give closer personal attention to the details, the results which are fairly satisfactory might have been more so, and more progress in disseminating a knowledge of the improvements among the people might have been made.

Nature of Demonstrations.

2. The demonstrations made during the year were—

(1) In the use of bone meal as manure for winter rice.

(2) In the use of Bordeaux Mixture as a preventive of potato disease.

(3) In grafting fruit trees.

The results obtained from each of these demonstrations are noted in paragraphs 3 to 5 of this note.

Bone-meal on rice.

Last year (1909), the use of bone meal in combination with saltpetre was demonstrated in 20 separate fields. The 20 fields were situated in 15 different villages, and had a total area of

2·36 acres. Side by side with the manured plots were contral plots which were not manured, but which otherwise were, to all appearance, of the same quality as those which received bone-meal and saltpetre. The total area of the unmanured plots was 2·22 acres. To the manured plots, bone-meal was applied some time before the rice seed was sown at the rate of 3 maunds per acre; and later on, after the crop had grown a few inches high, saltpetre was applied at the rate of 30 seers per acre. The fields being then full of water, it is very probable that the saltpetre which is a highly soluble manure was washed out as soon as it was applied, and very likely its effect on the crop was *nil*. Every one of the twenty manured plots showed a considerable increase in outturn of both grain and straw over the contral plots. The total yields of the manured and the unmanured plots were—

—	Total area.	Total yield.		Yield per acre.	
	Acre.	Grain.	Straw.	Grain.	Straw.
1	2	3	4	5	6
	Acres.	Mds.	Mds.	Mds.	Mds.
20 manured plots ...	2·36	39·75	47·12	16·84	19·96
20 Unmanured plots ...	2·28	22·62	28·92	9·92	12·70
Increase due to manure	...	17·13	18·20	6·92	7·27

The increase in grain alone was nearly 7 maunds per acre which, valued at Rs. 3 per maund, would more than cover the price of 3 maunds of bone-meal and 30 seers of saltpetre at Rs. 4-4 and Rs. 9 per maund respectively. If we leave out the price of saltpetre which, as stated above, could produce but little effect on the crop, the margin of profit would be considerably increased. Moreover, the efficacy of bone-meal does not end with the year in which it is applied, but is expected to last for some years. We found last year that two other fields which had received bone-meal at the rate of 3 maunds per acre in

1908, produced a considerable excess of grain and straw in 1909 over the contral areas which had been left unmanured. The actual results in these two cases were as follows :—

		Actual area.	Yield of grain per acre in 1909.
		Sq. yds.	Mds.
1st case	Plot manured with bone-meal in 1908.	251	21·68
	Plot unmanured	391	10·83
2nd case	Plot manured with bone-meal in 1908.	187	35·46
	Plot unmanured	165	25·77

It is expected that the manured plots will continue to yield larger outturns than the unmanured ones for at least a year or two longer.

In the present season (1910), 19 field demonstrations in bone-meal have been organised. The use of saltpetre has been abandoned, and bone-meal (bone-dust) alone at the rate of 3 maunds per acre has been used. In 1909, the plots selected for the demonstrations were too small in size. This year larger plots have been selected for the purpose, the total area of the 19 plots that have been manured being 5·66 acres and that of the 19 contral plots being 5·24 acres. The crop is now on the ground ; so far as can be judged from present indications, the manured fields promise to give larger yields than the unmanured ones.

To ascertain how long the effect of bone-meal will last, the plots which were manured with bone-meal in the last two years (1908 and 1909), as well as their respective contral plots have been marked out, and their yields will be noted again this year.

Khasia cultivators have begun to appreciate the usefulness of bone-meal as manure for the winter rice crop. Last year three men prepared a coarse kind of bone-meal by collecting bones and pounding them for themselves, and this year five others have done the same. Some Khasia cultivators have been so impressed with the value of the manure that they have purchased some ten maunds of bone-dust this year from the Upper Shillong Farm at full price (Rs. 4-4 per maund) and used it in their rice fields. Altogether

the prospects of bone manure coming into use in the Khasi Hills seem hopeful. A fairly keen demand for this manure has arisen, to meet which we propose to import a few tons of it from Calcutta and stock it at Upper Shillong for sale among the raiyats. We got up 20 maunds of bone-dust last winter, the whole of which has been used up. It cost about Rs. 4-4 per maund landed at Upper Shillong.

Spraying potatoes with Bordeaux Mixture.

4. During the past season (summer of 1910) 17 field demonstrations were organised in 14 different villages in the Khasi Hills. The crop in one field was destroyed by flood, and in another the contral plot which was left unsprayed for purpose of comparison was so small as compared with the plot that was sprayed that the results obtained could not be accepted as reliable. The 15 plots which were sprayed had an aggregate area of 4·06 acres; and the total area of the 15 contral plots which were left unsprayed was 3·57 acres. Most of the sprayed plots received two sprayings with Bordeaux Mixture during the year; two plots were sprayed only once. The mixture was applied at the rate of 240 gallons, costing Rs. 17-8 per acre. The season proved exceedingly wet, and there was scarcely any interval of fine weather sufficiently long to permit of spraying being used to the best advantage or of the mixture remaining long enough on the plants to exercise its full effect. The result was that the sprayed plots failed to show such a decided increase in yield of potatoes over the unsprayed ones as was obtained in previous demonstrations. In seven out of the 15 demonstrations, the sprayed plots gave an increase in yield of 10 maunds or over per acre. In these cases the spraying which cost Rs. 17-8 per acre, left a net profit. In 5 demonstrations the increase in yield was less than 10 mds. per acre, and in three the outturn of potatoes from the sprayed plots was less than from the contral areas. In these cases, the spraying treatment resulted in a net loss. The partial failure of the spraying demonstrations in the past season has arisen solely from the unfavourable character of the weather, and it is to be hoped it will not diminish the esteem in which this remedy began to be held by potato-growers in the Khasi Hills. During the year 9 Khasia raiyats purchased copper sulphate (the chief ingredient of Bordeaux Mixture) from the Farm, and one man purchased a hand sprayer for use in his potato field.

Grafting.

5. The grafting of fruit trees in the villages has been making good progress. No record has been kept of the grafts made prior to June 1910. From the 13th June to the end of August 1910, the two fieldmen have made a total of 285 grafts, of which 171 were pears, 25 apples, 32 peaches, 39 nectarines, 14 plums and 4 apricots. An examination of the grafts will be made next spring to ascertain how many of them have proved successful. While making the grafts, the fieldmen instructed the owners of the trees in the art of grafting. Much good is likely to result from this instruction.

Experiments in the rice fields.

6. Besides demonstrating the agricultural improvements described in the preceding paragraphs, a certain number of experiments with winter rice for which facilities do not exist on the Government Farm are being made in the holdings of some selected raiyats. One of these is designed to test the merits of transplanting rice against sowing it broadcast which is the rule in the higher plateaux of the Khasi Hills. This experiment was made for the first time in 1909 but proved a failure, the transplanting having been made as late as the 20th of June which did not leave enough time for the seedlings to grow and tiller sufficiently well. The experiment is being repeated in the present season in four different villages. Care has been taken to do the transplanting about the same date as that on which the seed was sown broadcast on the contrasted plots. The results of the experiment will not be known before November next.

Another line of experiment initiated during the year is to test the suitability of several varieties of rice new to the district. Two of these are varieties from the Assam Valley, three from Manipur, one is a Japanese rice of which acclimatised seed has been obtained from the Bengal Agricultural Department and one variety has been imported from Queensland. The results of the experiment will be reported next year.

ANNUAL REPORT ON THE TROPICAL PLANTATION AT WAHJAIN FOR THE YEAR ENDING THE 30TH JUNE 1910.

History and description.

The tropical plantation was started in January 1904. It is situated on the southern slopes of the Khasi Hills—the home of the Sylhet orange—and occupies the top and slopes of a ridge about 1,200 feet above the sea level. The site of the plantation was selected by Rai B. C. Basu, Bahadur. It is close to the Cherrapunji-Theria bridle-path and about seven miles below Cherrapunji.

The plantation was opened under the orders of Sir Bampfylde Fuller with the idea of experimentally introducing certain of the tropical products of Ceylon and Madras. Mr. Basu was deputed by Government in the Autumn of 1903 to Madras and Ceylon to study the cultivation of these products and to procure seeds and plants. Various tropical fruit-trees, new to the Khasi Hills, were procured for trial, most of them being obtained from the Royal Botanical Garden at Peradeniya in Ceylon and from Madras. The plantation also contains a small area planted with coffee, which has been introduced by private enterprise into the Khasi Hills, and a large number of the more common economic plants of the country, such as oranges, different species of citrus, of betel-nut, pan and black-pepper. These are being cultivated for observation and study.

The plantation has an area of 53·54 acres. The whole area was under forest at the time of acquisition. The first operation undertaken was to mark out a number of fields and to remove the forest by felling and burning. In two fields the forest has not been wholly removed; the larger trees having been retained for shade and the ground underneath cleared of undergrowth. These two fields are intended for the rearing of such plants as cardamoms, which are unable to stand full exposure to the sun. Up to the close of the year under report 14·50 acres have been planted. This area is divided into six fields, the lowest of which is 600 feet below the top of the ridge.

Soil.

2. The soil is very poor and deficient in the chief plant foods. Over the greater part of the plantation it consists of a shallow, loose loam, dark on the surface due to admixture of organic matter, but yellow underneath. In many places it is mixed with gravel, with occasional sandy patches. All over the surface

boulders protrude. These consist chiefly of sandstone, but out crops of limestone also occur. The boulders to a certain extent prevent the soil from being washed away by the annual heavy rains which fall on these slopes, but in spite of this there is a considerable wash of soil down the slopes every year, and this is accelerated as more jungle is cleared. Many of the plants suffer in consequence, much of the lemon grass being actually uprooted after heavy falls of rain by the washing away of soil from the roots. In view of this fact it is clear that many plants will have to be removed to some new site, preferably at the foot of some of the adjoining valleys, where the soil is deeper and richer in organic matter and an area of approximately level land can be obtained.

Two samples of soil from the plantation were analysed by Dr. Leather, with the following results:—

—	No. 1.	No. 2.
1	2	3
Per 100 *parts of whole soil.*		
Stones	3·62	17·48
Fine earth	96·38	82·52
	100·00	100·00
Per 100 *parts of fine earth.*		
Insoluble silicates and sand ...	72·63	78·43
Ferric oxide	5·43	2·86
Alumina	10·85	11·20
Manganous oxide	0·09	0·03
Lime	1·06	0·15
Magnesia	0·53	0·41
Potash	1·74	1·97
Soda	0·10	...
Phosphoric acid	0·05	0·02
Sulphuric acid	0·06	0·01
Carbonic acid	0·07	0·05
Organic matter and combined water	7·34	4·87
	100·00	100·00
Nitrogen	0·15	0·05
Available P_2O_5	0·0015	0·0004
„ KO	0·009	0·008

Dr. Leather reported as follows on the two samples :—

"No. 1 contains a fair amount of organic matter and nitrogen and a large amount of potash (total), but the amounts of carbonate of lime and readily available phosphates and potash are decidedly small. No. 2 is a quite different soil. It is white and contains comparatively little iron, with a high proportion of alumina. Of the chief plant foods it contains only very little, and should respond well to any complete manure".

Sample No. 1 was taken from a spot containing limestone rock, and No. 2 from a spot a few feet away which rested on sandstone. Sample No. 2 represents the main class of soil found on the plantation.

Climate.

3. Wahjain lies a short distance below the plateau of Cherrapunji, which holds the world's record for rainfall, and which it resembles in respect of the heavy precipitation that occurs during the Spring and Summer months. During the Spring and early Summer (March to May), the weather is characterised by high winds and frequent thunderstorms, with heavy bursts of rain, which bring on a quick growth of vegetation. The monsoon follows with rainfall not much less than that of Cherrapunji itself, and is succeeded about the middle or end of October by calm and almost rainless weather, which continues through the winter till about the middle of March.

There is far too much rain during eight months of the year and practically none for a continuous period of four months. Herein the climate of Wahjain differs from that of Ceylon and other tropical countries where such long periods of drought are unknown. The absence of rain has been found particularly trying to such essentially-tropical plants, as the nutmeg and clove, the latter of which has died out. It is also very possible that the winter temperatures of Wahjain are too low to suit such plants. The lowest recorded temperature in the shade was 43F°. in February 1905 and the highest 90°F. in May 1908.

4. The rainfall on the plantation from July 1909 to June 1910 was as follows :—

Character of the Season.

Month.	Rainfall.	Number of rainy days.
1	2	3
	Inches.	
1909, July	38·35	21
„ August	66·91	28
„ September	19·96	17
„ October	16·26	9
„ November	0·74	3
„ December	0·27	2
1910, January	0·11	1
„ February	2·26	3
„ March	33·34	13
„ April	35·16	14
„ May	25·40	20
„ June	85·00	25
Total for the year ...	325·76	159

This season has been characterised by heavy rains during the months of March and April and the total is 42·19 inches over the average of the two previous years. The highest temperatures recorded during the year were 86° in the months of July and September and the lowest 55° in the month of December.

Work done during the year.

5. The chief work done during the year has consisted of the distillation of lemon grass oil, the budding of oranges on various citrus stocks, and the ordinary routine work of manuring, pruning, and jungle clearing.

Pruning.

In December the following trees were pruned, *viz.*, ketembella, sapota, soursop, cashew nuts, citrus, oranges, mangoes, nutmegs, litchis, cocoa, and coffee.

Manuring.

In February all the trees in the plantation with the exception of local oranges and limes, camphor, cardamoms and cinnamons, were manured with a mixture of cowdung, leaf-mould and oilcake, the quantities varying according to the size and age of the plants, and in the same month the soil at the base of the cocoa plants and coffee (except those under shade) was "mulched" with the refuse from the distillation of lemon grass oil.

In each of the fields leaf-mould pits have been dug in order to have at hand a supply of leaf-mould for manurial purposes.

Lemon grass.

The distillation of lemon grass oil has continued during the year. Three cuttings and distillations have been made. The first (Tyrna and Moriani grass), started on July 1st, 1909, and continued till July 19th; the second (Tyrna, Moriani, Ceylon lemon-grass and Cochin) lasted from November 24th to December 15th; the third (Tyrna, Moriani, Ceylon and Cochin lasted from April 27th to May 17th. During the year Cochin lemon grass has been distilled for the first time, and if any reliance can be placed on the figure, it would seem that this grass yields less oil than the other varieties. The exact botanical determination of these grasses is still uncertain, as with the exception of the Cochin grass, none have as yet flowered on the plantation. The following table shows

the amount of grass cut during the year and the oil obtained in fluid ounces :—

—	Amount of grass.	Oil fluid ozs.	Oil fluid ozs. per maund of grass.
1	2	3	4
	Maunds.		
1st distillation—			
Tyrna	24¾	94	3·79
Moriani	6	24	4·00
2nd distillation—			
Tyrna	36	139	3·86
Moriani	3	12	4·00
Ceylon	3	12	4·00
Cochin	20	47	2·35
3rd distilation—			
Tyrna	17¾	66	3·72
Moriani	3	13½	4·50
Ceylon	4	20	5·00
Cochin	7¾	24	3·09
Total ...	125¼	451½	.....

The total quantity distilled during the year has been 451½ fluid ozs. and the total quantity of oil at present on the plantation is 1,046½ fluid ozs. During the year 30 ozs. have been disposed of to private persons at 4 annas an oz.

The distillation of lemon grass oil at Wahjain has now gone on systematically for three years and results so far prove that oil of marketable quality can be produced at a

cost not exceeding 2 annas per fluid oz., and it is still possible to introduce improvements in the method of distillation. This matter is being gone into in conjunction with the Agricultural Chemist. The question of finding a ready market for the oil, however, still remains to be solved. Small quantities of oil can easily be disposed of in India at a considerable profit, but unless a more extended market can be found, it will not be worth while continuing the industry.

A 2 ozs. sample of oil sent to the Imperial Institute, London, in September 1908, was submitted to brokers who valued it at 2½ annas per oz., but this is not sufficient to make the industry a profitable undertaking.

Experiments will, meantime, be continued to see if it is possible, by improvements in the method of distillation, to increase the quantity of oil without increasing the cost of production.

From the figures already obtained, it is seen that there is considerable variation in the quantity of oil produced per maund of grass, but Moriani and Ceylon would appear to yield the largest quantity, and it may be found more profitable to confine attention to these grasses alone. The question of the chemical composition of the oil obtained from the different grasses will also be gone into by the Agricultural Chemist.

The total area under lemon grass oil is now 4·12 acres, an extension of 26,562 square feet of Tyrna grass having been made in June of the present year.

Oranges and Citrus varieties.

In August 1908 several new varieties of oranges sent from Shillong were introduced. These include "Nanclencia," "Surprise Navel," "Gold Buckeye Navel," "Washington," "Gold Nugget Navel" and Japanese oranges. Several Pumelos from Calcutta were also planted in November 1909.

The experiments in budding oranges on various citrus stocks are being continued, both on the plantation and at Umlong. These experiments are being carried on with the object of producing plants which may prove immune to the orange disease which has prevailed for some years in the Khasi Hills, and also of studying the effect of the various stocks on the scions. In order to have at hand a number of stocks for budding on, a large number of seedlings of all the avail-

able local varieties of citrus have been raised on the plantation. A list of these is given in Appendix II.

Out of the 86 citrus plants planted at Umlong in July 1907, 65 are now alive and thriving and show no sign of disease. Four have died out during the year, due to water logging in the rainy months.

The other experiments started two years ago with the object of finding some means of combating the disease have not produced results of any value. These experiments consisted of cutting off the connection between healthy and unhealthy trees by means of trenches and of liming the soil at the base of diseased trees. The first experiment has totally failed to prevent the spread of the disease to healthy plants within the trench. In the second experiment the limed trees appear in a healthier condition than the untreated trees, but this may be due simply to the manurial effect of the lime, and not to the checking of the disease. This last experiment will have to be conducted on a larger scale and for a considerable period of time before the method could be definitely recommended.

It would seem that the best means of combating the disease lies in the direction of the selection of immune plants and the budding of the orange on hardy citrus stocks.

Plants under trial.

6. The annexed list shows the various species of plants under trial, the sources from which they were obtained, their age and the progress which each species has made. In the case of the plants which have begun to yield, the results obtained have been noted in the remarks column.

The most important plants for the sake of which the tropical, plantation was created, are cocoa, coffee, lesser cardamom, cinnamon, nutmeg, clove, lemon grass and camphor, but the climate at Wahjain is clearly unsuited to some of these plants. Cloves have entirely died out, and cocoa, nutmeg and cardamoms do not thrive.

Camphor.

7. The camphor trees continue to make good growth and are now about 8 feet high. Experiments in propagating the plants from root cuttings will be made during the coming year and some trial distillations of camphor will also be made.

Coffee.

8. The coffee in the exposed places suffers considerably from drought during the dry months. Those under shade are in a healthier condition. The plants were pruned in December. In November 1909 a crop of 10½ seers was obtained.

Cinnamon.

9. The cinnamon trees are very healthy and have a good growth of wood, the tallest having now attained a height of about 8 feet.

Nutmeg.

10. Like the cloves, which have all died out, nutmeg does not thrive on the plantation. The plants are growing very slowly, and every year several plants die of drought during the dry months. This year four have succumbed.

Cardamoms.

11. Neither the lesser nor the greater cardamoms have succeeded well. Many have succumbed to a fungus disease and others died of drought during the dry months.

12. Of other plants on the plantation, pine-apples, Natal oranges, sapota, litchis and mangoes are thriving, though the Ceylon pines appear to have deteriorated in size and quality. New stock will probably have to be introduced, as it is known that pine-apples deteriorate after a few years of continuous vegetative propagation in the same place. A considerable extension of the Ceylon variety has been made during the year, 500 new suckers having been put down. This year 60 fruits have been obtained.

Receipts and expenditure.

13. The expenditure on the plantation for the year has amounted to Rs. 1,311-2-4, including establishment, and the receipts from the sale of lemon-grass oil, pine-apples, orange and tezpat seedlings, to Rs. 132-10-7.

Inspection.

14. The plantation has been inspected once by the Director of Agriculture and three times by the Economic Botanist.

Dacca,
The 10th August 1910.

G. P. HECTOR,
Economic Botanist,
Eastern Bengal and Assam.

APPENDIX I.

List of Plants at the Tropical Plantation, July 1910.

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
1	Cocoa (*Theobroma cacao*).				
	"Amelando" ...	Grown from Ceylon seed.	August 1904.	1	Out of 20 trees planted in the rains of 1904, only 1 now remains. The cocoa trees are growing too slowly to promise success.
	"Caracas" ...	Ditto ...	August 1904.	1	One died of drought, December 1909.
	"Forestro" ...	Ditto ...	August 1904.	1	Two died of drought, December 1909.
	"Candeamar" ...	Ditto ...	Rains, 1904	11	Three died of drought, December 1909. Most of the survivors are growing well.
			Total ...	14	
2	Lesser Cardamom (*Elettaria Cardamomum*).				
	"Palni" ...	Palni Hills ...	June 1904	2	
	Ditt ...	Grown from seed procured from the Palni Hills in Madras.	April 1905	10	The plants are attacked by a root fungus and many have died. The "Mysore" variety has all died out.
			Total ...	12	Clumps.

APPENDIX I—*continued.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
3	Greater Cardamom (*Amomum Subulatum*).	Plants obtained from Shillong.	June 1903	20	The plants obtained from Darjeeling have died out.
			Total ...	20	Clumps.
4	Nutmeg (*Myristica fragrans*).	From Ceylon seed	April 1905	8	Only 8 have survived out of 80 seedlings planted in 1905. The plants are still small, and are growing very slowly.
5	Cinnamon (*Cinnamomum Zeylanicum*).	Ditto ...	Ditto ...	22	The 22 clumps contain 68 plants. They are making good growth.
6	Khasi (Cinnamon)	Locally procured	September 1903.	9	
7	Camphor (*Cinnamomum Camphorum*).	Plants from Ceylon	July 1904	9	Growing beautifully. The plants are bushy and displaying an exuberant growth.
8	Coffee (*Coffea Arabica*).	Locally procured	May 1904	26	Growing well. Most of the trees are now in bearing.
	Ditto ...	Ditto ...	April 1905	300	Growing well. Most of the trees of 1905 and 1906 are now in bearing. During the past year a crop of 10½ seers was obtained.
	Ditto ...	Ditto ...	June 1906	400	All the coffee in exposed places suffers from drought during the dry months.
	Ditto ...	Ditto ...	June 1907	109	
	Ditto ...	Ditto ...	June 1908	105	
	Ditto ...	Ditto ...	May 1909	38	
				1,067	

APPENDIX I—*continued.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
9	Orange (*Citrus Aurantiumm*)—				
	"Victoria Mammoth" or "Natal."	Natal	April and June 1904.	9	Growing well but show little sign as yet of bearing fruit.
	"Jamaica" ...	From Jamaica seed	June 1907	13	Growing well.
	"Malta" ...	Lahore ...	April 1906	6	Ditto.
	"Khasia" ...	Local ...	June 1904	50	Growing very well.
	Ditto ...	*Ditto* ...	June 1906	441	Growing well.
	Ditto ...	Ditto ...	June 1908	250	
	"Navelencia" ...	.....	August 1908.	1	These were obtained from Shillong, but there is no record of where they originally came from.
	"Surprise Navel"	.....	Ditto ...	1	
	"Gold Buckeye Navel."	.....	Ditto ...	1	
	"Washington Navel."	.....	Ditto ...	1	
	"Gold Nugget Navel."	.....	Ditto ...	1	
	"Japanese" ...	.....	Ditto ...	1	
			Total ...	772	
10	Citrus of different species—				
	"Malta Citron"	Cutting from a tree in the abandoned Government citrus plantation at Therriaghat.	Summer, 1905.	4	Growing well.
	"Soh-mad" (*citron*).	Ditto ...	Ditto ...	24	Making fair growth.
	Soh-myndong"	Ditto ...	Ditto ...	23	
	"Soh-kwit" ...	Ditto ...	Ditto ...	21	
	"Soh-myngor" (*pummelo*).	Ditto ...	Ditto ...	17	
	"Soh-niamriang"	Ditto ...	Ditto ...	17	
	"Soh-pai" ...	Ditto ...	Ditto ...	24	
	"Soh-khyllah" ...	Ditto ...	Ditto ...	10	
	"Soh-thang" ...	Ditto ...	Ditto ...	13	
	"Soh-sying" ...	Ditto ...	Ditto ...	21	

APPENDIX I—*continued.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
10	Citrus *of* different species—*concld.*—				
	C. Decumana ...	Japan ...	June 1907	2	Making poor growth.
	Ditto ...	Calcutta ...	Nov. 1909	5	
	C. Medica Chirocarpa.	Ditto ...	Ditto ...	1	
	C. Nobilis satsuma	Ditto ...	Ditto ...	2	
	C. Nobilis Kinakani.	Ditto ...	Ditto ...	2	
	C. Nobilis *Unshim*	Ditto ...	Ditto ...	1	
	C. Kinkan (round fruit).	Ditto ...	Ditto ...	1	
			Total ...	188	
11	Litchi (grafted) (*Nephelium Litchi*).	Calcutta ...	June 1904	2	Growing very well. One tree has borne fruit for three years and the other has fruited this year.
12	Mango (grafted) (*Mangifera Indica*)—				
	"Fazli" ...	Ditto ...	Ditto ...	2	All growing well. 'Fazli' and Bombay have flowered and borne fruit.
	"Langra" ...	Ditto ...	Ditto ...	2	
	"Bombay" ...	Ditto ...	Ditto ...	2	
			Total ...	6	
13	Sapota (*Achras sapota*).	Calcutta ...	June 1904	2	Growing very well. Both have flowered this year.
14	Papaya (*Carica papaya*)—				
	"Bangalore" ...	From garden seed	June 1909	3	Three only survived out of 14 seedlings in July 1909. One has flowered and fruited.

APPENDIX I—*continued.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
15	Pine-apple (*Ananas sativus*), "Ceylon."	Dibrugarh Jail, and suckers from original plants.	Rains 1904, 1906 and 1907.	755	All growing well. Sixty fruits were obtained this year, but the quality appears to have deteriorated. This pine-apple is of larger size than the country fruits; the eyes are shallow, flesh white, very succulent and of nice flavour, though slightly more sour than the indigenous kinds. The leaves differ from those of country variety in having smooth edges. The variety is expected to be popular.
	Ditto ...	Ditto ...	July 1908	98	
	Ditto ...	Ditto ...	July 1909-1910.	500	
	"Calcutta" ...	From Reporter on Economic Products to the Government of India, Calcutta.	September 1907.	2	
	Ditto ...	Ditto ...	June 1910	3	
	"Chin" ...	.....	October 1907.	9	
	"Kew" ...	Ceylon, and suckers from original.	July 1904, July 1906, July 1907, February 1908.	20	Growing well. The older plants are now in bearing.
	.....	.....	June 1910	23	
			Total ...	1,412	
16	Plantain (*Musa sapientum*)—				
	Strawberry-flavoured, "Bombay."	Empress Botanical Gardens, Poona.	May 1908	10	Growing slowly. The soil is too poor for planting, unless it is planted directly after burning the forest.
					N.B.—Besides these, the plantation contains a large number of Khasi and Assam Valley plantain of several varieties, grown chiefly for the sake of shade. The clumps have become old and are dwindling.

APPENDIX I.—*continued.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
17	Breadfruit (*Artocarpus incisa*).	Ceylon	July 1904	1	Growing slowly.
18	Mangosteen (*Garcinia Mangostana*).	Ditto ...	April 1907	6	The plants exhibit little growth and are unpromising.
19	Sandoricum (*Sandoricum sp.*)	Ditto ...	Ditto ...	1	These plants were received from Peradeniya for trial. It is not known what the fruits will be like, except in case of *Cochin Goraka*, which is wild in the Assam forests and known as *tepor tenga* in Assam Valley and *dia-phal* in Sylhet. *Ketam bella* and *Sandoricum* are growing well. *Cochin* Goraka shows very poor growth. *Nam-nam* has died during the past year.
20	Ketembella (*aberia gardeneri*).	Ditto ...	Ditto ...	2	
21	Cochin-Goraka (*Garcinia Xanthochymus*).	Ditto ...	Ditto ...	2	
22	Rambutan (*Nephelium lappaceum*).	Plants from Ceylon	July 1904	7	The plants are growing slowly. The tallest is 19' high.
	Ditto ...	Raised from Ceylon seed.	April 1905	2	
			Total ...	14	
23	Soursop (*Cuona muricata*).	Plants from Ceylon	July 1904	7	Growing fairly well. Three have died of drought during the dry months.
		Raised from Ceylon seed.	April 1905	12	
			Total ...	19	
24	Betel-nut (*Areca Catech*).	Local	1905 ...	200	This number has survived out of some five hundred planted on 1905 along the boundaries of fields A, B, C, and E. They are growing very slowly.
25	Betel-leaf (*Pan, Piper betel*).	Ditto ...	August 1904	3	These have survived out of 30 plants planted in 1904 and 100 in 1905. Growing well.
			June 1905	20	
			Total ...	23	

APPENDIX I—*concluded.*

Serial No. of species.	Names of species and variety.	Whence obtained.	When planted.	Number of plants.	Remarks as to growth, etc.
1	2	3	4	5	6
26	Cashew nuts ...	Raised from seed...	June 1908	100	These have survived out of 80 plants planted in 1904 and 100 in 1906. Growing well.
27	Black pepper (*Piper nigrum*).	Local	August 1904	5	These have survived out of 250 seedlings sown in June 1908.
			June 1905	28	
			Total ...	33	
28	Lemon grass (*Cymbopogon citratus*).	From three distinct sources, *viz.*:—	See column 3.	Area Sq. ft.	
		(1) Ceylon under name of lemon grass in April 1905.	.....	15,671	
		Ditto ...	1907 ...	7,950	
		Ditto ...	1908 ...	4,428	
		(2) Tyrua in August 1904; name not known.	.....	85,972	
		Ditto ...	June 1910	28,563	
		(3) Moriani, Assam Valley, in December 1904; name not known.	.....	31,626	
		Ditto ...	.....	85	
	Lemon-grass (*C. flexuosus*).	Cochin under name of lemon grass in June 1906-1907.	.....	5,073	Distilled for the first time this year.
		Ditto ...	1908 ...	2,000	
			Total ...	179,567 or 4·12 acres containing 9,999 clumps fit for distillation.	

APPENDIX II.

Number of plants raised from local seed during the year.

	Name.	Number of seedlings.
	1	2
1.	Local orange (Soh-niamtra)	206
2.	„ citrus (Soh-myngor)	27
3.	„ „ (Soh-Kwit)...	150
4.	„ „ (Soh-myndong)	71
5.	„ „ (Soh-niangriang)	61
6.	„ „ (Soh-mad)	19
7.	„ „ (Soh-khyllah)	63
8.	„ „ (Soh-sying)	37
	Total ...	[illegible]

APPENDI X III.

Plants distributed through the plantation during the year.

Name of plants.	Number of plants.	Number of persons
1	2	3
Orange seedlings	5,620	5
Khasi pine-apples (suckers)	10	1
Cylon pine-apples (suckers)	562	40
Kew pine-apples (suckers)	5	1
Tyrna lemon grass (rootlets)	100	7
Cochin lemon grass (rootlets)	100	10
Ceylon lemon grass (rootlets)	50	5
Moriani lemon grass (rootlets)	50	5
Tezpat seedlings	125	2
Total ...	6,622	76

ANNUAL REPORT OF THE AGRICULTURAL STATIONS

IN

EASTERN BENGAL AND ASSAM

FOR THE

YEAR ENDING ON 30TH JUNE 1911.

SHILLONG:

PRINTED AT THE EASTERN BENGAL AND ASSAM GOVERNMENT PRINTING OFFICE.

1911.

Price 1 *Shilling.*] [*Price* 12 *annas*

Agents for the sale of Books published by the Government of Eastern Bengal and Assam.

Agents in India.

(1) Messrs. Thacker, Spink & Co., Calcutta.

(2) Messrs. W. Newman & Co., Calcutta.

(3) Messrs. S. K. Lahiri & Co., Calcutta.

(4) Messrs. A. M. and J. Ferguson, Ceylon.

(5) Messrs. R. Cambray & Co., 6 and 8/2, Hastings Street, Calcutta.

(6) Messrs. Thompson & Co., Madras.

(7) Babu Hari Ram Dhar, B.A., Popular Library, Dacca.

(8) Messrs. D. B. Taraporevala Sons & Co., 103 Meadow Street, Fort, Post Box No. 187, Bombay.

Agents in England.

(1) Messrs. Constable & Co., 10, Orange Street, Leicester Square, W. C.

(2) Messrs. Kegan Paul, Trench, Trübner & Co., 43, Gerrard Street, Soho, W., London.

(3) Mr. B. Quaritch, Grafton Street, New Bond Street, W.

(4) Messrs. P. S. King & Son, 9, Bridge Street, Westminster, S. W., London.

(5) Mr. B. H. Blackwell, 50 and 51, Broad Street, Oxford.

(6) Messrs. Deighton Bell & Co., Cambridge.

(7) Messrs. Henry S. King & Co., 65, Cornhill, E. C., London.

(8) Messrs. Grindlay & Co., 54, Parliament Street, S. W., London.

(9) Mr. T. Fisher Unwin, 1, Adelphi Terrace, London, W. C.

(10) Messrs. W. Thacker & Co., 2, Creed Lane, London, E. C.

(11) Messrs. Luzac & Co., 46, Great Russell Street, London, W. C.

Agents on the Continent of Europe.

(1) MM. Friedländer & Sohn, 11, Carlstrasse, Berlin.

(2) M. Otto Harrassowitz, Leipzig.

(3) M. Karl Hiersemann, Leipzig.

(4) M. Ernest Leroux, 28, Rue Bonaparte Paris

(5) Martinus Nijhoff, The Hague, Holland.

SHILLONG:

PRINTED BY E. HILL, PRESS SUPERINTENDENT, EASTERN BENGAL AND ASSAM.

CONTENTS.

ANNUAL REPORT OF THE DACCA AGRICULTURAL STATION.

	Pages.	Paras.
Map of Dacca—		
Description of the farm	1—3	1-2
Reclamation, road-making and building ...	3—5	4-7
High land improvement experiments ...	5—10	9-14
Winter paddy, experiments in manuring ...	6	10
Ditto, planting experiment ...	8—9	11
Sugarcane, variety experiment ...	9	12
Cotton, new fodder crops, soybeans, *til*, etc.	9—10	13-14
Report on the high land soil and note on the scheme of manuring	15—21	Appendix

ANNUAL REPORT OF THE BURIRHAT AGRICULTURAL STATION.

Map of Burirhat—		
History and description	25	1—4
Soil analyses	25—28	3
New buildings	28	4
Weather and crops	28—30	5—6
Tobacco experiments	31—42	7—13
Oats, mustard, wheat	42	14—16
Potatoes	43—44	17
Green manure crops	44	18—19
Fodder crops	44—45	20—21
Groundnuts, 'aus' paddy	45	22—23
Seed distribution and new implements ...	*ib.*	24—25
Expenditure and receipts	46	26
Establishment and inspection ...	*ib.*	27—28

Appendix :—Report received from Professor Dunstan Director, Imperial Institute, London, on the results of the examination of tobacco... 47—52

ANNUAL REPORT OF THE RAJSHAHI AGRICULTURAL STATION.

Introduction	53	1—2
Winter paddy experiments	54	4
Sugarcane experiments	54—55	6

ANNUAL REPORT OF THE JORHAT AGRICULTURAL STATION.

	Pages.	Paras.
Map of Jorhat—		
Description	59	1—2
Sugarcane experiments	61—70	6—8
Application of lime to the soil ...	70—71	9
Groundnuts	71	10
Potatoes	*ib.*	11

ANNUAL REPORT OF THE SHILLONG FRUIT EXPERIMENT STATION.

Description of the station and objects for which it is maintained	73—74	1—9
The year's work and weather	74—75	10—13
Fruit trees	75—76	14
Other crops	76	15
Propagation and distribution	*ib.*	16
Sericulture	76—77	17
Establishment and inspections	77	18—19
APPENDIX A.—Summary of fruit trees ...	79	
„ B.—Plants and seed issued in 1910-1911 ...	80	

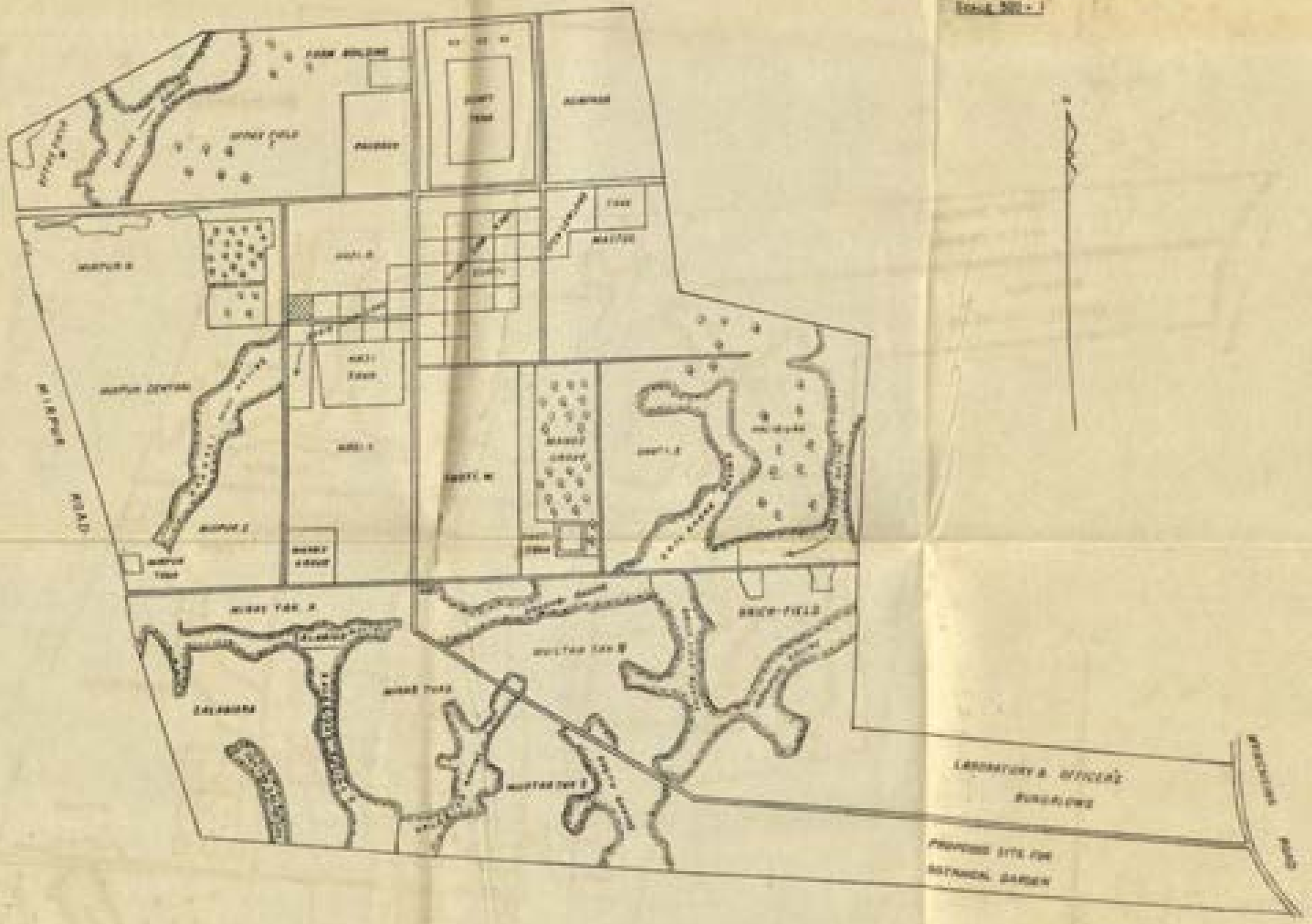
ANNUAL REPORT OF THE UPPER SHILLONG AGRICULTURAL STATION.

History, description and purposes for which the station is maintained	81—82	1—2
The weather in 1910-11 and ummary of work done	82	3—4
Potato experiments—tests o varieties, whole *versus* cut sets, methods of lanting, cultivation of potatoes for seed	82—88	5—9
Fodder crops	88	10
Ensilage	88—89	11
Other crops under trial—oats, flax, New Zealand flax, soybeans	89	12
Cattle and sheep breeding	90—91	13—14
New implements	91	15
Receipts and expenditur	92	16

ANNUAL REPORT OF THE WAHJAIN AGRICULTURAL STATION.

Description of the farm	93—95	1—2
Climate	95	3
Character of the season	95—96	4
Work done during the week	96—98	5
Expenditure	99	6
Inspection	*ib.*	7

— MAP —
- OF -
— DACCA CENTRAL FARM —



ANNUAL REPORT OF THE DACCA AGRICULTURAL STATION FOR THE YEAR ENDING 30TH JUNE 1911.

Introduction.

The farm is situated about five miles north of Dacca town, and has a total area of 353·7 acres. The land was acquired in 1906. At the time of acquisition the greater portion was covered with jungle and coarse grass.

The farm is the main experiment station of the Province, and also the headquarters of the superior staff of the Department. The laboratory and officers' bungalows have been completed and all the officers are now in residence.

Land.
3 *bighas* = 1 acre (approximate).

2. There are three distinct types of land on the farm :—

(1) High land (about 860 *bighas*).
(2) Open lowland (about 35 *bighas*).
(3) Ravine land or *holas* (about 173 *bighas*).

The high land forms the greater portion of the farm. It is composed of a stiff red laterite soil, the chief characteristic of which is the rapidity with which it loses its moisture and becomes hard and dry. Before acquisition most of this land was under jungle. Dotted here and there were the houses of a few cultivators, who grazed their cattle in the jungle and took crops of winter paddy from the surrounding *holas*. A few patches of *aus* paddy, *til* and mustard were also grown on the high land by the cultivators, but their chief means of livelihood was the cultivation of winter paddy in the *holas*.

The open lowland usually goes under water some time during the rains, and in a normal season jute can be grown followed by winter paddy. This land is from 2 to 3 feet below the general level of the high land; the soil is on the whole in better condition than that of the high land, as it receives some of the washings from the high land.

The ravine lands or *holas* wind in and out amongst the high land, cutting it up into irregular shaped blocks. Never more than about 150 feet wide; they vary in depth from 2 or 3 feet up to 6 or 8 feet below the level of the high land. This land has been cropped by the raiyats with winter paddy for generations, practically without manure, the fertility

being sustained by washings from the high land and by the growth of leguminous weeds, which are brought up by the early rains in the spring.

The farm, on the whole, may be said to be representative of a large jungle tract cut up by ravines and extending northward from the Dacca town. In this jungle are scattered villages, the occupants of which regularly cultivate winter paddy on the low land and *holas*. The high land is uncultivated, except small patches here and there where the villagers grow good crops of *aus* paddy and *til* in the rains. As soon as the rains come to an end, the land sets like a brick and in consequence there is very little *rabi* cultivation. A little *mung*, *matikalai* and mustard is however cultivated in patches.

The plan of the farm inserted in this report, will give some idea as to the distribution of the land.* Most of the high land is very uneven in character, so it has been laid out in large blocks, which are being cropped uniformly as far as possible until such time as we are able to select plots of approximately equal fertility for experiment. A report on the condition of the soil of this Station written by the Agricultural Chemist and myself is printed as an Appendix to this report.

Work done during the year.

3. As the high land has been found to be so uneven in character most of our experimental work up to the present has necessarily been confined to the lowland and *holas* where the soil is more uniform; but a certain amount of preliminary work has been carried out on the high land which has enabled us recently to lay down a definite scheme of experiments with the object of ascertaining the most profitable means of bringing this land into a more fertile condition. This scheme is referred to in the appendix to this report. The bulk of this high land is at present being cropped uniformly without manure (except occasional green manuring) and an attempt is being made on some of the more promising portions of it to test our progress in bringing it into a more even state of fertility by weighing the produce of *bigha* plots into which several large areas have been divided.

The work done during the year under report will be described under the following heads :—

(*a*) Reclamation of land.

(*b*) Road-making and draining.

(*c*) Building.

(*d*) Reclamation of tanks.
(*e*) Experimental cultivation.
(*f*) Non-experimental cultivation.

Reclamation of new land.

4. During the year about 12 *bighas* of land bearing thatching grass were levelled and brought under cultivation. The Ransome Turnwrest plough mentioned in previous reports was used for breaking up the land.

The mango groves, which extend to about 87 *bighas*, were thoroughly cleared of jungle and hoed with the *kodali*, and one large grove was heavily thinned so as to admit of the land being more easily ploughed between the trees. At present the land of the farm is divided approximately as follows :—

	bighas.
High land under cultivation	424
Open lowland under cultivation	35
Ravines under cultivation	173
Paddock for cattle	10
Mango groves	87
Botanical area, poultry runs, etc.	67
Tanks	54
Sites of buildings, roads, drains, etc.	153
Unreclaimed land, mostly under thatching grass ...	67
Total	1,070

Road-making and draining.

5. The road leading from the main road of the farm to the assistants' quarters on the brickfield was metalled departmentally at a cost of Rs. 2,500, and also the central cross road running westwards from the brickfield to the main road at a cost of Rs. 2,137.

A wide metalled road was also made round the farm buildings at a cost of Rs. 1,000.

In order to prevent surface wash from the high lands to the *holas* during heavy showers of rain, a device was tried which is said to have proved successful in Bihar. This consists in making low bunds of earth on the brink of the high land where it slopes towards the "*holas*". The bunds are made just sufficiently high to hold up the surface water to allow the silt to be deposited, without causing the water to lie long enough to injure the crops. In this way it is possible to gradually silt up the sloping land and bring up to the average level of the high land.

This method has been tried successfully on several blocks of high land on this farm; but owing to the violent rain-storms to which we are liable in this locality, the bunds need constant watching and repairing in order to prevent them from being washed away entirely.

Building work.

6. During the year the following quarters were erected departmentally for the laboratory staff:—

	Rs.	a.	p.
For 1st Assistants to Fibre expert, Agricultural Chemist, and Economic Botanist—			
Three quarters—No. 1 ...	1,804	12	0
No. 2 ...	1,963	8	0
No. 3 ...	1,786	8	0
For Agricultural Chemist's 2nd Assistant 1 at a cost of ...	1,296	8	0
For Entomological Collector 1 at a cost of	969	4	0
For Mycological Collector 1 at a cost of	1,010	4	0
For Clerks, two quarters—No. 1	823	0	0
No. 2	856	0	0
For Laboratory Servants, Peons, etc., two blocks each containing quarters for 8 men, No. 1 block	1,581	0	0
Ditto, No. 2 block	1,564	4	0

The arrangements for housing the staff of the farm and laboratory are now fairly complete. An additional building will however have to be erected for the accommodation of students deputed for practical training.

A pucca well 6 feet in diameter and 30 feet deep, fitted with a pump, was sunk near the site of the assistants' quarters at a total cost of Rs. 1,200.

Another similar well has been sunk in the kitchen garden for irrigation purposes. This well is fitted with a chain pump. The cost of the well and pump amounted to Rs. 1,200.

The walls of two of the farm overseers' quarters were rebuilt, kutcha brickwork being substituted for ekra and mud plaster, which had been badly damaged by storms.

Reclamation of tanks.

7. Two old tanks, *viz.*, the Hazi and Shati were re-excavated during the year and the banks dressed and levelled at a cost of Rs. 1,500

and Rs. 750, respectively. The latter is being used for steeping jute.

Experimental cultivation.

8. This included :—

a. An experiment on the improvement of the high land.

b. Manurial experiments with winter paddy.

c. Planting experiment with winter paddy.

d. Preliminary trials with several varieties of sugarcane.

e. Trials of miscellaneous crops including cotton, euchleana mexicana, Japanese clovers, paspalum, Soybeans and several varieties of Til (Sessamum Indicum.

f. A small experiment to test the effect of lime on the soil of the high land.

g. Fibre crops.

High land improvement experiment.

9. This was commenced in 1908. The main object being to test the effect of green-manuring in the improvement of this class of soil.

The experiment consists of four plots each 1½ acres in area, two of which are green-manured annually in the rains, one with Dhaincha and the other with Sann Hemp, followed by a crop of oats in the cold weather.

The other two plots are cropped annually with aus paddy in the rains followed by a pulse crop in the rabi season. One receives an annual dressing of 100 maunds of cowdung per acre and the other about 300 maunds per acre of vegetable refuse which has been previously stored in pits until thoroughly well rotted.

Dhaincha is found to answer better than Sann as a green-manure crop on this soil. The oat crop was poor on both plots, but the yield on the plot green-manured with Dhaincha was double that obtained from the plot green-manured with Sann.

The plot manured with cowdung produced 31 maunds 27 seers of *aus* paddy as against 28½ maunds from the plot manured with decayed vegetable refuse. The pulse crop which followed the *aus* practically failed for want of moisture and the yields were insignificant.

This year half of each plot has been given a dressing of slaked lime at the rate of 30 maunds per acre. The effect of

this, in a year or so, is expected to be very marked, especially on the green-manured plots. In fact the good effect of the lime is already noticeable on the growth of the present season's crops.

Winter paddy manurial experiments.

10. The results of the manurial experiments made in 1908 and 1909 in the eastern ravine were published in last year's report of this farm. These results demonstrated that bonemeal used alone at the rate of 3 maunds per acre, gave excellent results, but that when soluble manures, such as saltpetre, ammonium sulphate and calcium nitrate, were added they reduced the profit considerably. This was no doubt due to some extent to the soluble manures having been more or less washed out by flood water, but as this soil is now known to be extremely deficient in phosphorus, which element of plant food the bonemeal supplied, it would appear that the other manures not containing this essential constituent were simply superfluous and therefore unprofitable.

In order to test how far the manures applied in 1908 and 1909 will affect succeeding crops it is proposed to grow a crop of winter paddy on these plots annually for three years without any further manuring. The first crop without manure was taken in 1910 and the results of this crop together with the average results for 1908 and 1909 are given in the following table.

Per Acre—Average of duplicate plots.

Manures applied, 1908 and 1909.	Average of 1908 and 1909.			1910, without manure.		Remarks.
	Yield.		Profit.	Yield.		
	Grain.	Straw.		Grain.	Straw.	
1	2	3	4	5	6	7
	Mds. srs.	Mds. srs.	Rs. as.	Mds. srs.	Mds. srs.	
Green-manured (*Dhaincha*)	24 1	32 5	39 14	19 6	12 30	The amounts of fish manure, calcium nitrate, ammonium sulphate and cotton seed applied in 1908 and 1909 contained nitrogen equal to that contained in 30 seers saltpetre.
Ditto (Sann Hemp)	14 5	17 21	4 9	14 23	10 16	
Nil	17 7	26 31	20 9	23 0	13 37	
Bonemeal 3 maunds	24 6	44 29	36 1	25 1	18 22	
Bonemeal 3 maunds and saltpetre 30 seers	23 19	40 21	25 4	22 23	18 37	
Ditto 3 maunds and ammonium sulphate	22 23	41 7	24 8	25 36	20 6	
Ditto 3 maunds and calcium nitrate	26 23	38 1	33 11	26 2	21 37	
Ditto 3 maunds and cotton seed	23 37	39 11	28 5	25 13	23 22	
Ditto 3 maunds	26 13	47 29	43 1	27 30	21 29	
Fish manure	32 15	35 6	34 15	21 10	22 12	
Nil	21 13	32 28	37 3	21 19	21 9	
Average of all plots manured with bonemeal alone ...	25 13	46 8	39 9	26 20	20 5	
Average of all unmanured plots	19 10	29 9	23 14	21 29	17 23	

The chief thing demonstrated by these figures is the lasting effect of the bonemeal. It will be seen that on all the plots but one to which bonemeal was applied in 1908-1909 either alone or in combination with other manures, the yield has been well maintained in 1910 and on the majority of plots has even been exceeded.

This year's result on the plots green-manured with *dhâincha* is disappointing, and it would appear from the figures that the green-manure was only effective in the years when it was actually applied. This however tends to confirm our experience that on soils such as these, which are extremely poor in lime, the full benefit of green-manure crops cannot be obtained unless the deficiency in lime is made good. We have accordingly this year commenced experiments on both high and lowland with the object of ascertaining the effect of lime in conjunction with green-manuring.

The fish manure which produced the highest yield in 1908-09 has apparently left no manurial residues as the yield in 1910 dropped to about the same as that of the unmanured plots.

Another point brought out in the table is the low yield of straw in 1910 as compared with that in the previous years. One would be inclined to ascribe this to the absence of direct manuring in 1910, but for the fact that the unmanured plots have suffered to the same extent as the manured ones, the only explanation one can offer is that it is due to the effect of "Season."

Winter paddy planting experiment.

11. This experiment which is described in last year's report as having been commenced in 1909 was repeated in duplicate during the year under report.

The object of the experiment is to ascertain how far the numbers of seedlings transplanted per unit area affect the outturn of the crop. The local practice of planting bunches of seedlings is wasteful of seed and also of land for seed-bed, and if it can be clearly demonstrated that as good or better results can be obtained by transplanting less seedlings per acre, it follows that a great saving of seed and land will be effected.

We have now the figures for the first two years of the experiment, but as no very conclusive result has been obtained we do not consider it advisable to publish them at present. The experiment is being repeated during the current season. Next year we propose to amplify the scheme

somewhat, taking into account the rate of seed used in the seedbed and also the effect of early and late planting on the number of seedlings transplanted.

It is interesting to note that the "single plant" system of transplanting which has been so much advocated in some parts of this country, does not, judging from results obtained up-to-date, appear to be suited to our local conditions, the yields in nearly every case being lower than when more than one plant was used.

Sugarcane.

12. This crop was tried for the first time at this station in 1909, a small plot of the local *ganderi* variety having been grown with fair success. This plot was ratooned in the year under report and an additional area of about 2½ bighas was planted. In addition to the local *ganderi* cane the following varieties were tried on a small scale for the first time at Dacca. All these were brought from the Jorhat Agricultural Station (Upper Assam) :—

Striped Mauritius.

B 147, B 1753, B 376, B 208 } Originally from Barbadoes.

Striped Tana.

Yellow Tana.

Magh.

Kheri.

The land was manured with 450 maunds of cowdung and 20 maunds rape cake per acre and the sets were planted in rows, 4 feet apart with 2 feet between the sets in the rows.

All the varieties grew well and, with the exception of a slight attack of borer, were quite healthy. As it was decided to plant a large area this year the bulk of the crop was cut up for sets, so no comparative results were obtained. Generally speaking, however, the growth of the Striped Mauritius and one or two of the Barbadoes varieties which have done well at Jorhat gave one the impression that they are likely to prove superior to the local cane when they get accustomed to their changed conditions.

Miscellaneous crops.

13. *Cotton.*—Several varieties of cotton seed supplied by the Imperial Cotton Specialist were sown on about a *bigha* of high land in Sunti field, but the crop entirely failed.

Euchleana Mexicana.—An Australian fodder-crop was tried for the first time on a small area. The crop grew fairly well, but it seems improbable that it will ever equal joar as a fodder-crop on this land. About a maund of seed was saved for sowing in the following season.

Japanese clovers.—These germinated well, but were stunted in growth and eventually failed.

Paspalum grass was sown on a small area, but failed to germinate.

Soybeans.—Two varieties, green and yellow, were tried for the first time. The former germinated but made no growth, and the latter failed to germinate.

Til.—Several varieties obtained from Bombay were grown for trial. These included Kanara from Dharwar, Hinari from Dhulia and a variety of white *til* from Surat. The first two varieties made fair growth but the outturn was very poor. The variety from Surat was badly injured by insects and the crop failed.

Several varieties of *til*, mustard and pulses were grown in Sunti high land for the Economic Botanist.

High land lime experiment.

14. A strip of land about 1 *bigha* in area in Shati west field was divided longitudinally into two equal parts. To one portion lime was applied in the spring of 1909 at the rate of 30 maunds per acre, the other portion being untreated. A crop of *aus* paddy was sown over the whole area. The limed portion produced 16 maunds 38 seers of grain per acre while the yield from the untreated portion was only 10 maunds 39 seers per acre.

Fibre crops.

15. A large number of fibre crops including jute, rhea, sida, sann hemp, malachra capitata, etc., were grown under the supervision of the Fibre Expert. Selected varieties of jute were also grown on fairly large areas for seed.

Non-experimental cultivation.

16. *Kharif-aus paddy* was sown on the following high-land areas :—Mirpur (north, central and south), Hazi and Shati west—the total area being about 119 *bighas*. The varieties grown were Surjamukhi, Chingri, Gorfa, Pankang, Fulbadam, Boalguri and C. P. fine.

The total outturn of grain was 806 maunds. About 25 *bighas* of lowland in Hazi and Rakhali Byde were sown with *aus* paddy followed by winter paddy. The land

was given a dressing of 75 maunds of cowdung per acre before sowing the *aus*. The outturn of grain from the *aus* crop was 104 maunds.

Dhaincha.—This crop was grown on the following areas : Paddock (10 *bighas*), Agirgaon (32 *bighas*), Mastul Bag (30 *bighas*), Mastul lowland (4 *bighas*) and Mirartak south (29 *bighas*).

It was ploughed in for green manure on all the areas except Agirgaon and Mastul Bag which were too wet for ploughing during the rains, so the crop was left standing for seed.

Sann hemp.—Seven *bighas* were grown for green manure in Mirartak north.

Cowpeas.—A small area was tried for green manure in Mirartak north.

Maize and Rahar.—A mixed crop of maize and rahar was grown on 24 *bighas* in Mustartak north and south. The maize was cut green and fed to the farm bullocks. The rahar was allowed to mature and yielded 84 maunds of grain. About 7 *bighas* of maize was grown alone also for fodder.

Joar—Was grown on the office field. The crop was cut green for cattle fodder.

Rabi cropping.—*Matikalai* was grown in Hazi south, Mirpur, Mirartak south and office field, the total area being about 169 *bighas*. The crop was badly damaged by hairy caterpillars. Most of the areas were grazed off by the farm cattle. About 23 maunds of grain was obtained from the remaining area.

Mung —Was sown in Hazi north and Shati west on a total area of about 34 *bighas*. The crop in Shati west was fed to the cattle. A very poor yield of grain was obtained from the remainder of the area.

Til.—About 12 *bighas* of local *til* was grown. The outturn was only 11 maunds 32 seers.

Ravine and lowland cropping.—All ravine land not under experiments was cropped with 18 good varieties of winter paddy. The total area thus cropped was 140 *bighas* and the total outturn 1,023 maunds of paddy. A portion of lowland about 15 *bighas* in area was utilized by the Economic Botanist for his experiments with winter paddy.

17. *Establishment.*—The sanctioned establishment consists of—

1	Superintendent (Agricultural Supervisor)	Rs. 250—10—400
2	Overseers	„ 30—2—50
1	Extra Overseer (for up-keep of buildings)	„ 30—2—50
1	Clerk on	„ 25—1-8—40
		Rs.
1	Blacksmith on	38
1	Carpenter on	30
8	Apprentices on	15
1	Darwan on	10
1	Peon (Agricultural Supervisor's)	8
1	Peon (Farm)	8
2	Chaukidars	8

At present the farm is in charge of Babu Kali Das Ray (Farm Superintendent), Mr. J. N. Chakravarty, Agricultural Supervisor, having been transferred to Shillong.

Four apprentices completed their training during the year and have been appointed temporary demonstrators on Rs. 20 per month.

Three new apprentices were appointed during the year, one from Malda, one from Mymensingh and the other from Noakhali districts, one vacancy still remains, which will be filled as soon as a suitable candidate is found.

18. *Cattle.*—Five work bullocks were purchased locally during the year at a total cost of Rs. 231.

Towards the end of June an outbreak of Hæmorrhagic Septicæmia on the farm caused the death of two bullocks. The Veterinary Superintendent inoculated the other animals and strict precautions were taken against the spread of the disease with the result that no other fatalities occurred.

Implements.

19. In addition to the ordinary local country implements we have the following in use on the farm :—

Ransome's Turnwrest ploughs.
Hindustan ploughs.
Meston plough.
Rajeswar plough.
Bihar seed drills.
Drag harrows.
Bullock hoes (Bakhar)

The Turnwrest ploughs have been found especially useful in breaking up new land and ploughing in green manure. We have tried two types, the B. T. and C. T. The C. T. is the larger one and we have found it more useful than the other. It takes two pairs of good bullocks to work it and will cultivate from 6″ to 9″ deep according to the state of the land. In fairly loose soil nearly an acre can be ploughed in a day, but the average area ploughed on the stiff clay soil of the farm is about two *bighas* or about two-thirds of an acre. The price of this plough is Rs. 24, excluding freight. If half a dozen are imported together, the price of each including freight, would amount to about Rs. 30. The smaller plough B. T. does not take so much draft and can be worked with smaller bullocks, but it is not so effective as the other. Its price is Rs. 19-8, exclusive of freight.

The "Arlington" plough (an American make) mentioned in the previous year's report, has been found to be too heavy for two pairs of our bullocks, so its use has been discontinued.

The Hindustan, Meston and Rajeswar ploughs have been found useful in fairly loose soil, but the heavy clay soil of the farm is rather too much for them. In fact, it is not fair to judge them from their work at the Dacca Farm, as the soil is exceptional.

Receipts and expenditure.

20. The receipts and expenditure for the year were as follows :—

	Rs.	a.	p.	Rs.	a.	p.
Receipts—						
Agricultural produce ...	4,038	10	3			
Fuel	38	12	0			
Fruit	91	7	9			
Thatching grass ...	62	5	0			
Miscellaneous ...	32	13	6			
				4,264	0	6
Expenditure—						
Establishment (pay and allowances)				8,085	7	0
Capital charges—						
Petty construction ...	21,472	4	3			
Live-stock ...	231	7	6			
Reclamation ...	7,545	9	0			
Implements, etc. ...	387	13	0			
				29,637	1	9

Non-Capital charges—

	Rs.	a.	p.	Rs.	a.	p.
Labour	11,303	13	6			
Cattle food	2,283	7	0			
Seeds, plants and manures	1,882	5	0			
Petty repairs (buildings) ...	1,356	13	3			
Petty repairs (roads, drains, fencing).	500	6	6			
Purchase and repairs of country implements.	855	11	0			
Furniture ...	106	1	9			
Miscellaneous ...	1,292	8	6			
				19,581	2	6
Grand total ...				57,303	11	3

A. G. BIRT,

Deputy Director of Agriculture,
Eastern Bengal and Assam.

APPENDIX.

Report on the high-land soil and note on the scheme of manuring.

	Surface soil. Laboratory sample No. 3.	Sub-soil. Laboratory sample No 3a.
Soluble in Hydrochloric Acid—		
Phosphoric acid (P^2O^5)	0·04	0·04
Potash (K_2O) ...	0·30	0·49
Lime (CaO) ...	0·18	0·10
Magnesia (MgO) ...	0·38	0·33
Soluble in 1 per cent. Citric Acid.—		
Phosphoric acid (P^2O^5)	0·003	0·002
Potash (K^2O) ...	0·013	0·008
Organic matter and combined water ...	4·66	4·38
Nitrogen ...	0·134	0·093
Calcium carbonate ...	0·047	0·024
Reaction of soil ...	acid	acid.
	Ferrous iron present in sub-soil.	

N.B.—Percentage calculated on dry soil.

The soil samples from the Dacca Farm were taken from a typical high-land area and may be taken to very fairly represent all the high land of the farm and very probably all similar land in the large tract known as the Madhupur jungle. The particular area in question had not been cultivated nor manured in any way at the time of sampling. The jungle had merely been cut down and rooted up. The surface soil when undisturbed extends uniformly to a depth of 4 or 5 inches, is darker in colour and altogether different in appearance from the sub-soil underlying it. One would term it a " stiff clay loam". The sub-soil underlying the above extends to a considerable depth and is of a deep red colour and very "harsh". In the dry state it resembles rather ground up bricks than a soil. It is composed of heavy red clay, and resembles the laterite soils of southern India very closely. Wherever the surface of the land has been disturbed during levelling work and wherever ant-hills have accumulated, there the red sub-soil comes to the surface and for reasons to be stated later on this is generally accompanied by barrenness in those spots. We are of opinion that the surface soil has been derived from the underlying sub-soil and has not been merely super-imposed,

the differences observable being due to the effect of surface vegetation and increased oxidation at the surface, and that by suitable tillage and cultivation the nature of this sub-soil can be materially altered and improved. This however will take time, but can no doubt be accelerated by suitable treatment. The high-land soil of the whole farm is undoubtedly in very bad condition, physically, biologically and chemically.

Physical features.

The full physical examination of these soils will be made later; all one can say at present is that the soil is extremely difficult to work, that owing to the presence of innumerable small nodules or accretions apparently of iron oxides in the soil it is almost impossible to get a fine tilth on the surface, that inspite of the fact that the soil is capable of absorbing a very large amount of water during the rainy season and thereby becoming almost puddled, its capacity for retaining moisture is very small and it very readily parts with the whole of this water immediately the rains cease and cracks badly; to such an extent is this the case that it is at present almost impossible to grow *rabi* crops on this class of soils, for lack of moisture. This aspect is not being lost sight of and we have in view experimental work with the object of ameliorating these conditions.

Bacteriological features.

We believe the soil also to be in a bad condition, biologically from several considerations:

Firstly, so far as tested by us (and we have tested soil from many parts of the farm), the soil is all in a more or less acid state. Acidity is quite inimical to the well being of those soil organisms, whose presence is most to be desired. An acid soil is never a healthy one. Bacterial life generally is suppressed in favour of the growth of moulds and microfungi which compete actively with the crop for the plant food of the soil.

This acidity is well reflected during the rains in the natural herbage. As observed by us this consists chiefly of sedges and other acid loving plants. Wherever these abound one may be sure that an unhealthy soil condition exists.

Again, we have observed that the root nodules common to leguminous plants never develop on the roots of peas sown on this land, unless the soil is very heavily manured with cow-manure.

We do not offer any explanation of this fact. We merely record it as evidence against the general bacteriological condition. Mr. Hutchinson, Imperial Bacteriologist, has volunteered to take up the bacteriological study of these soils and we are in communication with him relative to this work.

Chemically the soil presents some interesting features. Before going on to discuss the analytical figures reported, one would like to make mention of a simple experiment made during the cold weather as a test of the sub-soil of the high land. From field observations, we had formed the idea that most cultivated plants received a check as soon as their roots reached the sub-soil. This was confirmed by the oft observed fact that crops sown over areas where the sub-soil has been exposed during levelling operation, hardly make any growth at all. In all cases they make very much less growth than those plants growing on the undisturbed soil, *i.e.*, where the surface soil overlies the sub-soil.

Chemical features.

Four pots were accordingly filled up as follows :—

No. 1.—All sub-soil.

„ 2.—A layer of surface soil 1½″ deep overlying sub-soil.

„ 3.—A layer of surface soil 3″ deep overlying sub-soil.

„ 4.—A layer of surface soil 4″ deep overlying sub-soil.

Mustard was sown on the same day in all pots—

In No. 1.—The seed all germinated and the plants attained a height of 1″.

2.—Growth was better, the plants attaining a height of from 2″—3″.

3.—Growth was still better, the plants growing to a height of 4″—6″.

4.—Where conditions approximated to field condition, growth was best of all and the plants grew to from 8″ to 10″ in height.

Every seed germinated even in the case of the pot entirely filled with sub-soil. It will be seen therefore that there is ground for the belief that the sub-soil exercises some poisonous action on the growing plants so soon as their roots reach it.

The proportion of the plant foods in the surface and sub-soil is almost identical, so that one can hardly ascribe the above state of affairs to a greater lack of food material in the sub-soil.

The sub-soil contains ferrous salts which are known to be plant poison, and is no doubt in a thoroughly unhealthy and unoxidised state. It is in our opinion a case of years and years of thorough good farming combined with the use of green manures and lime and as will be subsequently seen we are instituting experiments accordingly.

Turning to the analytical figures, the first point one would wish to emphasize is the abnormally low percentage of lime carbonate (calcium carbonate).

The total lime present is also very deficient.

In the analysis of a soil without doubt the most important figure is the proportion of lime carbonate. It affects a soil in every way beneficially, physically, chemically and bacteriologically, besides indicating what class of artificial manures should be used. It improves the texture of a soil, favouring the penetration of both water and air and of the roots themselves. It neutralises acidity in the soil, maintaining these conditions necessary to abundant bacterial life and activity, more especially those of the decay and nitrification of organic matter thus supplying the readily assimilable form of nitrogen. Also it favours the development and activity of the root bacteria of legumes and of the other nitrogen assimilating bacteria, the azotobacter.

A proper proportion of lime carbonate also tends to keep the land free from fungoid diseases.

Chemically it tends to counteract the deleterious influence of an excess of magnesia in the soil and renders available directly or indirectly the reserves of plant food—phosphoric acid and potash, which may be present. It also admits of the proper action of any manures added. In its absence they do not exert their proper and full action.

The preferential washing out of lime rather than other plant foods is well known and one cannot wonder that years and years of heavy rainfall have nearly robbed the soil of the whole of its lime; it is a process which is continually going on.

We have thought it necessary to dilate at some length on this point in view of the treatment which will be subsequently recommended.

The ratio of magnesia to lime is also rather higher than one would desire being 2 : 1 for surface and 5 : 1 for sub-soil.

Of total potash in the soil there is no dearth but the total phosphoric acid is certainly quite inadequate. Potash available to plants is also present in quite sufficient quantities and we do not see any necessity of special potash manuring. Sufficient will be supplied in ordinary applications of cow manure to keep up the supply of this food.

The amount of phosphoric acid available to plants as shown by that soluble in 1 per cent. citric acid is very low, and this combined with the small amount of total phosphoric acid present points to the fact of a "real" and not merely a temporary lack of this food ingredient. We are of opinion that phosphoric acid manuring will be decidedly advantageous.

In considering what form of phosphate to apply to this soil, one must bear in mind that the soil is very deficient in lime and acid in nature. This precludes the application of any manure of an acid nature (such as superphosphate). Basic slag would undoubtedly be eminently suitable. It would supply lime as well as phosphoric acid. In view however of its excessive cost we are going to propose liming, together with the application of bonemeal to supply the phosphoric acid. The organic matter in these soils though (judging from the loss on ignition and the percentage of nitrogen) not so deficient as one might expect, might be advantageously increased. Fertility will never be maintained by the use of mineral manures alone. Green manuring with leguminous crops will increase the supply of organic matter and nitrogen and will improve the water retaining capacity, but we very much question whether green manuring will have the desired beneficial effects unless liming be first resorted to. Besides the purely chemical evidence afforded as to the necessity of (*a*) green manuring, (*b*) the application of lime, (*c*) phosphatic manuring, we have the field evidence of some three years to work on. There is field experience strongly in favour of all the above; with regard to our field knowledge of the action of green manures up to date, we are agreed that they have not so far shown that measure of beneficial action which might be expected and hoped for. The green manure plots laid down by Mr. Basu some three years ago, have been regularly green manured each rains and even then have certainly not responded to any very marked

extent although it is now possible to grow a small crop of oats on this land whereas this crop does not grow on the ordinary soil of the farm. But this is probably due to the effect of the green manure in improving the moisture holding capacity of the soil. We are so far convinced that this is due to the absence of lime carbonate in the soil, that we are this year cross-dressing the plots with lime. We fully expect this will show up the beneficient action of the green manures to a far greater extent than hitherto.

The field evidence in favour of lime is based chiefly on an experiment on oats and peas laid down 2 years ago. One half of the plots was cross-dressed with lime and the growth of the crops on that half was even in the first year far and away better than that on the unlimed half. The same is apparent this year also, but to a less extent, owing to the fact that the crop was sown too late when too much moisture had gone and it has suffered in consequence.

We may here say that improvement from liming generally grows from year to year after the application and is usually most apparent in the 3rd and 4th year. That we should have got such a response in the first year is somewhat surprising, but in the case of a soil so deficient as this is, we must be prepared for such surprises.

Reference to the current report will show that the application of phosphoric acid as bonemeal has given nearly a 50 per cent. increase on grain in the case of paddy and an increase approaching to 100 per cent. in the case of the straw.

All this then agrees with deductions made from purely chemical considerations, and the combined evidence is so strong that we have matured a scheme of experiment which will necessarily take some years to work out, and which embodies all the treatment suggested by actual field experience and general working knowledge of the soil's requirements in addition to the insight we have gained from the chemical analysis.

In deciding the lines of experiment, we have taken as a definitely decided fact that the addition of lime is absolutely essential and we have made this the very foundation of the scheme, and we think we are perfectly justified in so doing.

In our opinion, further work in this connection should be directed to elucidating facts relative to its application, *i.e.*, at what rates and at what intervals of time.

Broadly speaking then our scheme of experiment is an attempt to study the lime requirements of these soils on the above lines, with and without green manuring and again with and without the addition of phosphoric acid as bone-meal.

The application of Nitrogen in the form of cow-manure will be included and considered in combination with the above.

The inclusion of any kind of special potash manuring is considered quite unnecessary, the quantity of this element of plant food both in the available and dormant state being ample for all requirements.

In deciding the lines of the above work and the manures to be used we have considered the practicability of their subsequent adoption by the cultivators of this class of land.

A certain familiarity on their part may already be assumed with regard to green manures, bones and cow-manures. The same remarks would not apply to such substances as superphosphate or sulphate of ammonia, etc., some of which might replace some of the manures we propose to use. In our opinion however our soil and climatic conditions largely put the use of such artificials out of court, and it is perhaps fortunate that circumstances throw us back to such commonly occuring and commercial substances as bones and cowdung.

The use of lime as a manure is probably quite unknown and strange to most cultivators. The use of wood ashes, however, is well known, and if the cost of lime is not excessive in any district, we do not think there should be much difficulty in persuading them to adopt it.

The experiment will be laid down to continue for at least six years, but before the end of this period we hope to obtain sufficient evidence to enable us to recommend a thoroughly practical scheme for the reclamation of this soil.

A. A. MEGGITT,

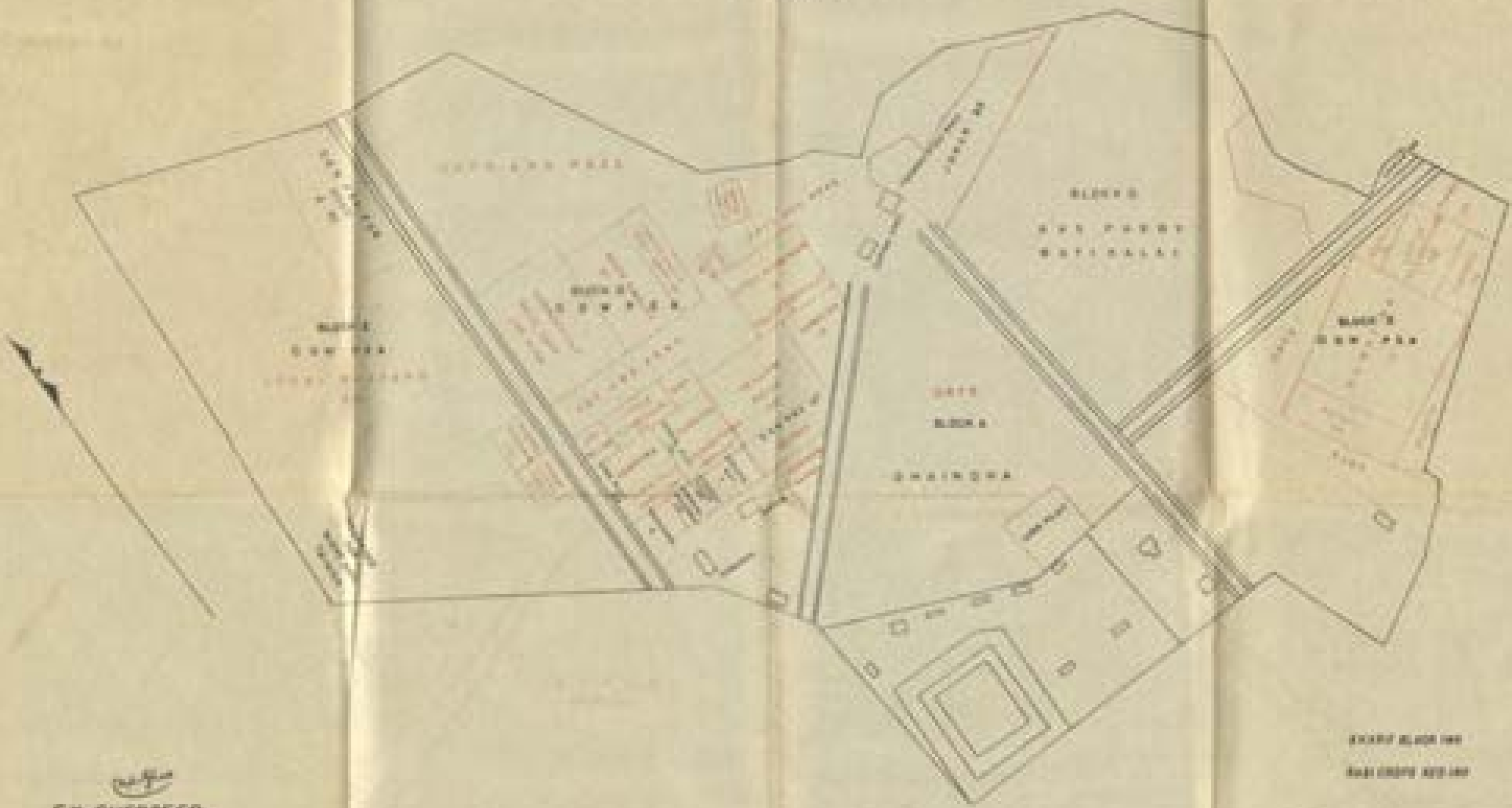
Agricultural Chemist,
Eastern Bengal and Assam.

The 14th March 1911.

A. G. BIRT,

Deputy Director of Agriculture,
Eastern Bengal and Assam.

— MAP —
— OF —
— BURIR HAT FARM —



E.K. OVERSEER

KHARIF BLACK INK

RABI CROPS RED INK

ANNUAL REPORT OF THE BURIRHAT AGRICULTURAL STATION FOR THE YEAR ENDING 30TH JUNE 1911.

Introductory.

The Farm, which is intended principally for experimental tobacco cultivation, is situated five miles north of Rangpur town and is about 52 acres in area. The land was acquired in 1907, but no establishment was kept there until the end of July 1908, when the Rangpur Farm establishment removed to Burirhat. A certain amount of preliminary work, such as jungle clearing, building, and road making, had been done, but the real work of the station was not commenced until the establishment had removed there.

Distribution of land.

2. The Farm occupies an irregular-shaped piece of land split up by roads into five main blocks, lettered A, B, C, D and E. There is also a small area set apart for a paddock and for the Farm staff quarters. Block E is completely isolated from the rest of the Farm by a road open to the public. The plan prefixed to this report shows the position and size of each block and the crops which it bore during the year.

3. The soil is a sandy loam with a sub-soil of almost pure sand which occurs at a depth of from 1 to 2 feet from the surface.

Mr. A. A. Meggitt., Agricultural Chemist, has taken up the study of these soils with the object of ascertaining the conditions in the "barren" patches which occur in several parts of the Farm with a view to their improvement.

The following table of analyses together with extracts from his report gives the results of some preliminary work which he has done on two samples of soil and two of sub-soil,

one from a "fertile" area and the other from a "barren" area :—

Soluble in hydrochloric acid with 12 hours' digestion.	Barren area.		Fertile area.	
	Sample 1 first 6".	Sample 1a second 6".	Sample 2 first 6".	Sample 2a second 6".
1	2	3	4	5
	Per cent.	Per cent.	Per cent.	Per cent.
Phosphoric acid (P_2O^5) ...	0·061	0·053	0·143	0·112
Potash (K_2O)	0·534	0·616	0·660	0·684
Lime (Ca O)	0·360	0·515	0·339	0·353
Magnesia (MgO)	1·101	1·112	1·500	1·696
Soluble in 1 per cent. citric acid with 7 days' digestion.				
Phosphoric acid	0·061	0·083	0·107	0·110
Potash	0·021	0·015	0·023	0·018
Lime	0·095	0·107	0·115	0·099
Magnesia	0·095	0·081	0·094	0·093
* Loss on ignition (= organic matter and combined water).	2·864	1·83	3·190	2·767
* Containing Nitrogen ...	0·000	0·040	0·087	0·072
Calcium carbonate	0·035	0·032	0·067	0·055

Reaction of soil—All very slightly acid.

"These soils present some interesting peculiarities.

"Broadly speaking there are no very marked differences between them. Certainly the differences are not so great as to make it easy to understand why one soil should be much more fertile than the other.

"In the analysis of a soil without doubt the most important figure is the proportion of calcium carbonate, a substance which exercises very far-reaching effects on the biological processes of a soil, and thus indirectly on the whole welfare of the same. Lime also exercises most pronounced effects on the texture of soils, and is active in bringing into pla y the reserves of plant food material lying dormant.

"If we look at these figures we shall see that the amount of calcium carbonate in the "fertile" soils is, though lamentably small, roughly twice that in the "barren" soils. In the case of such small quantities, doubling the amount of calcium carbonate (though still leaving the amount very small) might conceivably have a very large effect

"It will also be seen that the total lime and also that soluble in 1 per cent. citric acid are also very small.

The ratio of "total" magnesia to "total" lime is in all the soils far too high, being generally in the proportion of 3 or 4 to 1. Though this is not shown in the "available" condition, still the fact that the soil contains a larger reserve of magnesia will, in the ordinary course of soil processes, constantly tend to a too high ratio for magnesia to lime.

"As regards the other constituents, I should describe the total phosphoric acid in samples 1 and 1*a* as inadequate, and that in samples 2 and 2*a* as adequate. The total potash is ample in all samples.

"Total lime as previously remarked is low and bears too low a ratio to the total magnesia present.

"With regard to the available constituents there is certainly no lack of P_2O_5 or K_2O. Indeed in samples 1 and 1*a* the "available" P_2O_5 is actually equal to that obtained by solution in hydrochloric acid, and in the case of 2 and 2*a* the "available" P_2O_5 is very little less than the "total". Thinking that I might not have extracted the soil sufficiently long with hydrochloric acid, I repeated the experiment, extracting for periods twice and four times as long as the first extraction. These further experiments gave me figures almost identical with those given. It seems an extraordinary thing that the ratio between total and available P_2O_5 in these soils should be so low; it is almost 1 : 1 in all cases and it, of course, suggests that there are practically no reserves in these soils. It is especially extraordinary as there is quite a fair percentage of iron in the soil. It suggests of course that the phosphoric acid is almost entirely present as some easily soluble compound, probably a lime compound. Certainly in the case of samples 1 and 1*a* where the total and available P_2O_5 are identical figures, the amount of available lime is rather more than sufficient to account for the available P_2O_5 in the form of tricalcic phosphate. In sample 1*a* I actually found some small particles of bone.

"These soils, though not rich in nitrogen, cannot be said to be very deficient. Judging from the loss on ignition and the percentage of nitrogen the amount of organic matter, though not high, compares favourably with most Indian soils. Still both might be increased with advantage."

With the object of studying the effect of lime on these soils two plots each 1 *bigha* in area were set out on the worst portions of Block A and Block D last year, and slaked lime was applied at the rate of 10 maunds (820 lbs.) per acre. It is intended to repeat the dose annually for five years. Ordinarily the plots will be green-manured in the rains and a crop (*e.g.*, tobacco or oats) taken in the cold weather.

Buildings, etc.

4. The following buildings were completed during the year :—

		Rs.
Farm Superintendent's quarters	...	2,175
Fieldman clerk's ,,	...	713
Barn for fire-curing of tobacco	...	600

Also two coolie sheds, two bullock sheds, a shed for storing "bhusa," two latrines for coolies, and kutcha sheds over manure pits have been erected. An old tank which had become silted up was re-excavated and the banks levelled at a cost of Rs. 350.

As we have hitherto found it extremely difficult to keep cured tobacco in good condition during the rains, a pucca tobacco store-house provided with a fireplace and iron flue is being erected at a cost of Rs. 1,970 and will shortly be completed.

Season.

5. The following table gives the monthly rainfall from April 1910 to May 1911 inclusive, together with the approximate normal rainfall for these months :—

Month and year.	Actual.		Normal.	
	Rainfall in inches.	Number of rainy days.	Rainfall in inches.	Number of rainy days.
1	2	3	4	7
April 1910	·52	2	3·01	4·3
May ,, ...	14·30	14	10·66	11·5
June ,, ...	24·84	19	13·00	15·7
July ,, ...	26·89	26	15·89	15·0
August ,, ...	14·71	18	12·80	13·7
September 1910	7·17	15	14·24	13·3

Month and year.	Actua .		Normal.	
	Rainfall in inches.	Number of rainy days.	Rainfall in inches.	Number of rainy days.
1	2	3	4	5
October 1910	4·79	6	4·87	4·0
November „	·45	3	0·12	0·2
December „	Nil ...	Nil ...	0·05	0·2
January 1911	·38	1	0·50	0·9
February „	Nil ...	Nil ...	0·54	1·2
March „	1·19	5	1·25	1·8
Total	34·74	109	31·93	31·8
April 1911	6·12	8	3·01	4·3
May „	15·41	19	10·66	11·5

Lack of rain in December somewhat affected the growth of the tobacco on Block D and the greater portion of the crop had to be irrigated.

As in the previous year the wet weather in April and May seriously interfered with the harvesting and threshing of the oat crop.

Crops grown during the year.

6. The crops grown during the year are shown in the following table :—

Name of crop.	Area in acres.	Block in which grown.
1	2	3
Bhadoi.		
Dhaincha as green manure ...	4·95	A.
Cowpea as green manure ...	36·04	B and D (1) and E (1).
Cowpea for seed	2·92	E (11).

Name of crop.	Area in acres.	Block in which grown.
1	2	3
Bhadoi—concld.		
Jowar	1·11	C and C
Aus paddy	7·20	C.
Matikalai	7·20	C.
Euchleana mexicana	·10	D (11).
Bambara groundnut	·08	
Groundnut	·10	
Japanese pulses	·02	
Total ...	47·32	
Rabi.		
Tobacco	6·29	D and B.
Oats	6·16	A and B.
Oats and peas mixed as fodder ...	4·33	D.
Mustard	8·90	E.
Potatoes	1·30	B and D (11).
Wheat	·14	E.
Total ...	27·02	

The Ceylon pine-apples obtained from Wahjain (Khasi Hills) last year and planted on the farm are doing well.

The crops grown are dealt with in the following paragraphs, commencing with tobacco, the main experimental crop of the farm.

Tobacco : scheme of experiment.

7. The accompanying table shows the varieties of tobacco grown during the year and some particulars of their cultivation and the method of curing followed :—

Serial No.	Class of tobacco.	Variety.	Source of seed.	Area in acres.	Rotation.	Manure per acre.	Time of transplanting.	Date of commencement of harvest.	Mode of harvesting.	No. of leaves kept on a plant.	Mode of curing.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Cigar leaf tobacco.	Sumatra...	Farm grown seed of 1909-1910.	1·10 in B.	Green manure with cowpea.	75 maunds of well-rotted cowdung per acre and 1 maund saltpetre refined per acre (top dressed.)	25th Oct. to 7th Nov. 1910.	24th Dec. 1910.	Basal leaves primed; the rest cut whole.	18 to 20 leaves.	Shade cured.	The tobacco cured bright mahogany colour and is suitable for cigar wrapper.
		Ditto ...	Ditto ...	·36 in D.	Ditto ...	75 maunds of cowdung per acre, 5 maunds of oil-cake and 1 maund saltpetre (top dressed.)	18th Nov. 1910.	14th April 1911.	Ditto ...	10 to 12 leaves.	Ditto.	
		Ditto ...	Ditto ...	·16 in D.	Ditto ...	75 maunds of cowdung per acre and lime at 10 maunds per acre.	14th Nov. 1910.	11th Apl. 1911.	Ditto ...	Ditto ...	Ditto.	
		Ditto ...	Ditto ...	·16 in D.	Ditto ...	75 maunds cowdung per acre but no lime (check plot).	Ditto ...	Ditto ...	Ditto ...	Ditto ...	Ditto ...	Little or no difference was seen in the growth of 2 plots; the tobacco cured dark unfit for cigar wrapper. The leaves small. The soil was too poor to grow a good crop.

Serial No.	Class of tobacco.	Variety.	Source of seed.	Area in acres.	Rotation.	Manure per acre.	Time of transplanting.	Date of commencement of harvest.	Mode of harvesting.	No. of leaves kept on a plant.	Mode of curing.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
2	American cigarette tobacco.	Little Flemingen.	Farm grown seed of 1909-1910.	·56 in B.	Green manured with cow-pea.	75 maunds well rotted cowdung, 1 maund saltpetre (refined) (top dressed per acre).	29th Oct. to 18th Nov. 1910.	1st Jan. 1911.	Basal leaves primed; the rest cut whole with splitting.	12—16 leaves.	The whole of it was fire cured excepting a portion of bottom leaves.	Cured bright yellow.
	Ditto ...	Ditto ...	Ditto ...	·15 in D.	Ditto ...	Ditto and 5 maunds oilcake top dressed.	29th Nov. 1910.	...	.....	...	...	Growth failed entirely.
	Ditto ...	Ditto ...	Ditto ...	·60 in D.	Ditto ...	Ditto and 5 maunds of oilcake top dressed.	22nd Nov. 1910.	...	.....	...	...	The crop though irrigated totally failed to grow. The soil was too poor.
	Ditto ...	Connecticut seed leaf.	Ditto ...	1·24 in D.	Ditto ...	Ditto, besides in ·24 acres 166 maunds of cowdung per acre was applied later.	2nd Nov. to 9th Nov.	14th Apl.	Cut whole ...	10—13 leaves.	Fire cured	The soil was too poor to grow good tobacco as in the case of other tobacco in this block. Top dressing with oilcake and saltpetre together with irrigation was tried. The crop though at first nearly dying showed signs of vigorous growth

												in April. The rainy weather followed. The tobacco lost all its gum, would never mature and when cured turned out dark brown instead of yellow. Had not rains broken out unusually early this season tobacco might have perhaps cured far better.
	American cigarette tobacco.	Connecticut seed leaf.	Farm grown seed of 1909-1910.	·16	Lime plot	75 maunds well rotten cowdung lime 10 maunds per acre.	14th Nov. 1910.	11th Apl. 1911.	Cut whole after splitting the plants.	10—12 leaves.	Fire cured	.....
				·16	Check plot green manured with cowpea.	75 maunds well rotten cowdung, no lime.	...	...	.....	...	...	.....
		White Burley.	Fresh seed from America.	·51 in D.	Green-manured with cowpea.	75 maunds of well rotted cowdung, 8 maunds of oil-cake and 1 maund saltpetre per acre, top dressed. When even this failed 166 maunds of cowdung per acre and 7 maunds ashes per acre applied. Irrigation made.	3rd to 11th Nov. 1910.	14th Mar. 1911.	Cut whole of the splitting.	10—15 leaves.	Fire cured	The crop harvested before rainy weather set in, cured yellow but the rest brown. The soil was too poor and even the high doses of manure with irrigation failed to give a good growth. The leaves were very small.
		Yellow prior.	Seed from Cooch Behar, 1909-1910.	·66 in D.	Ditto ...	Ditto ...	28th Oct. to 4th Nov. 1910.	...	.....	...	...	The crop entirely failed to grow and was not fit for curing except a few plants here and there.
3	Turkish tobacco.	Sari Ayas-Salonk.	Seed fresh from Turkey.	·05 ·05 D.	Ditto ...	No manure at first 1 maund saltpetre top dressed afterwards.	26th Oct. 4th Nov. 1910.	3rd May 1911.	Cut *whole* ...	15—18 leaves.	A few plants fire cured.	.....

Serial No.	Class of tobacco.	Variety.	Source of seed.	Area in acres.	Rotation.	Manure per acre.	Time of transplanting.	Date o commencement of harvest.	Mode of harvesting.	No. of leaves kept on a plant.	Mode of curing.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13.
	Turkish tobacco.	Sari sown broad cast.	Seeds fresh from Turkey.	·25	Green manure.	No manure ...	Sown broad cast on 18th Oct. 1910.	25th Mar. 1911.	Cut whole ...	18—20 leaves	Fire cured	The plants originally failed to grow but after a few showers of rain in March it grew unevenly in patches.
(4)	Variety plot	Cavalla ...	Ditto ...	All these grown on 10 acres.								
		Sam Soun	Ditto ...									
		Sam Soun	Seeds supplied by Mr. J. B. De, of Cooch Behar State.									
		Canon Burley.	Supplied by Messrs. Peninsular tobacco Company, Monghyr.		Ditto ...	Ditto and 1 maund saltpetre top dressed.	27th Nov.	...	...	...	...	This tobacco all failed to grow and were not fit for curing.
		Sorisa ...	Tirhoot tobacco supplied by Bengal Agriculture Department.									
		Zimmer Spanish.	Farm grown seeds of 1909-1910.									

The scheme of experiments was practically the same as that followed in previous years, the objects being :—

1. To produce a high grade cigar wrapper leaf.
2. To produce tobacco suitable for the manufacture of good class cigarettes.

The variety grown for cigar wrapper was Sumatra, of which 1·1 acre was planted in Block B. and about ·68 acre in Block D. For the production of cigarette tobacco the following varieties of tobacco were tried—Little Flemingen, Connecticut seed leaf, White Barley and Yellow Prior (American) and Sari and Aya Salouk (Turkish). With the exception of ·56 acre of Little Flemingen on Block B all these varieties were grown on Block D.

In addition to the above a few other varieties were grown on small plots for observation (*vide* tabulated statement).

The Sumatra and Little Flemingen on Block B made excellent growth and gave satisfactory results ; unfortunately the same cannot be said of the tobacco grown on Block D. Tobacco was tried for the first time on this land and owing to poverty of the soil, which is very sandy, and lack of moisture the crop grew very badly and in spite of irrigation and applications of top dressings the results were poor.

Tobacco—Sources of seed.

8. Sumatra and Connecticut seed leaf were grown from our own seed saved in the previous year. White Barley seed was obtained from America, Cannon Barley from the Peninsular Tobacco Company, Monghyr, Yellow Prior from Cooch-Behar and the seed of the Turkish varieties direct from Turkey.

This year the flower heads of several plants of each variety were "bagged". The seeds of each plant will be kept separate and the progeny planted in single lines with the object of ascertaining how far the varieties which have been grown on the farm for several years have kept pure and true to type.

Tobacco manuring.

9. The whole of the land for tobacco was green-manured with a crop of cowpeas ploughed in about three months before the tobacco was planted, by which time the cowpeas had become thoroughly rotted and assimilated with the soil. The growth of cowpeas on Block B was remarkably good, but on Block D it was only fair.

About a month before planting the tobacco the land received a light dressing of well rotted cowdung at the rate of 75 maunds per acre.

The tobacco in Block D made such poor growth at the outset that in addition to the above manuring it was decided to try the effect of top dressings together with irrigation; accordingly a top dressing of 5 maunds of mustard cake and one maund of saltpetre per acre was applied in December and the crop was irrigated. Towards the end of January the prospects of the crop began to improve, but there still remained many backward plants which were treated with a dose of powdered cowdung. In February and March the crop was prevented from maturing properly by frequent showers of rain, consequently the quality of the tobacco was not so satisfactory as it should have been.

At the suggestion of the Agricultural Chemist a plot of land 1 bigha in area had been limed at the rate of 10 maunds of slaked lime per acre previous to sowing the cowpeas. Another plot of the same area remained untreated as a control. In addition, both these plots received a dressing of 75 maunds of cowdung per acre, but no top dressings were applied nor were they irrigated. The tobacco on both these plots was practically a failure and there was no apparent difference between the limed plot and the check plot. It is intended to apply 10 maunds of lime annually to the limed plot, green manure both plots with cowpeas in the rains and take crops of tobacco in the cold weather. Probably by next year the lime will have had time to take effect.

Tobacco : Curing.

10. All the Sumatra tobacco was shade cured in the three specially constructed curing sheds. The crop grown on Block B cured well and the bulk of it was found to be suitable for cigar wrapper. The results of the crop on Block D were not so satisfactory owing to stunted growth and consequent late harvesting.

The varieties grown for cigarette tobacco were fire-cured in a barn provided with flues for the purpose, this being the second season in which fire-curing experiments have been attempted. The results on the whole were decidedly encouraging. The crop of Little Flemingen from Block B and part of the White Barley from Block D gave light coloured tobaccos of the type desired by cigarette manufacturers. A small quantity of Turkish tobacco cured in the same way also gave good results. Connecticut seed leaf is usually regarded as a cigar tobacco, but last year a portion of the crop which was fire-cured as an experiment was

found to give tobacco suitable for cigarettes. Consequently this year the bulk of the crop was fire-cured with the result that it has given tobacco of very fair quality for cigarettes, although not so good as that produced by the White Barley and Little Flemingen varieties.

A full description of the methods followed in fire-curing is given in paragraph 12 of the annual report of this station for the year ending June 30th, 1910.

Tobacco: Yield and cost of cultivation and curing.

11. The following table gives particulars of the yields, cost of cultivation, etc., of those varieties which grew sufficiently well to be included in the curing experiments.

Yield of tobacco, 1910-11.

Serial No.	Name and variety of tobacco.	Area planted.	Method of curing.	Grade of tobacco.	Actual outturn.	Outturn per acre.	Actual cost of cultivation and curing.	Cost of cultivation and curing per acre.	Cost of cultivation and curing per maund.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
BLOCK B.					Md. s. ch.	Md. s. ch.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Cigar leaf tobacco.	Sumatra ...	1·10 ...	Shade cured ...	(1) Wrapper and binders, large.	10 20 0	...	...	...	...	This block was the only area in which Sumatra tobacco grew well and was fit for curing, the growth on a patch about ½ of an acre was poorer.
				(2) Medium ...	3 30 0	...	...		...	
				(3) Small ...	2 35 0	...	...	...	...	
				(4) Filler (Bispat) ...	1 0 0	...	...	...	...	
				Total ...	18 5 0	16 7 8	246 9 9	224 3 0	13 9 0	
American cigarette tobacco.	Little Flemingen...	·58 ...	Fire-cured ...	Tobacco of all grades	6 10 0	...	...	...	...	The growth of the crop was poor on about half the area, otherwise the outturn would have been much more than that obtained.
			Bispat shade-cured.	.....	0 20 0	...	...	...	...	
				Total ...	6 30 0	13 3 0	93 14 3	170 9 9	16 14 0	

Serial No.	Name and variety of tobacco.	Area planted.	Method of curing.	Grade of tobacco.	Actual outturn.	Outturn per acre.	Actual cost of cultivation and curing.	Cost of cultivation and curing per acre.	Cost of cultivation and curing per maund.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
BLOCK D.					M. S.	M. Srs. sh.				
American cigarette tobacco.	Connecticut seed leaf.	1·24 acre ...	Fire cured ...	Tobacco of all grades...	14 15	11 19 8	...	...	...	In this block the tobacco all failed to grow in the proper season and harvesting was not possible at the proper time, hence the curing was not so successful as it should have been.
	Ditto ...	·16 limed plot	Ditto ...	Ditto ...	1 15	8 10 0	...	...	...	
	Ditto ...	·16 check plot	Ditto ...	Ditto ...	1 11	7 26 0	...	...	...	
Cigar leaf tobacco.	Sumatra E ...	·36 ...	Shade cured ...	Ditto ...	3 0	8 13 5	...	...	...	
	Ditto ...	·16 limed plot	Ditto ...	Ditto ...	1 25	9 30 0	...	...	...	
	Ditto ...	·16 checkplot...	Ditto ...	Ditto ...	1 18	8 10 0	...	...	...	
Ditto ...	White Barley ...	·51	Fire-cured ...	Ditto ...	4 10	8 13 4				
	Little Flemingen	·75	...	Ditto ...	Practically failed and was not worth curing.					
	Yellow Prior ...	·66	...	Ditto ...						
	Variety plot ...	·10	...	Ditto ...						
	Turkish transplanted.	·10	...	Ditto ...						
Turkish cigarette tobacco.	Suri broad casted...	·25	Fired cured ...	...	Actual. 1 10	5 0 0	...	...	...	A portion of the tobacco coloured bright yellow.

As will be seen from the table, the outturn of Sumatra and Little Flemingen on Block B was satisfactory while, from causes already explained, the outturn on Block D was poor with the exception of Connecticut seed leaf which was fairly good.

The actual cost of cultivation and curing per maund of Sumatra and Little Flemingen is shown in column 10 of the statement. This includes all expenditure except rent of land and value of cowdung which was produced on the farm. In the case of Little Flemingen, which was fire cured, the cost of fuel has not been taken into account. This would probably increase the cost of production by from Rs. 5 to Rs. 6 per maund of cured leaf, if the fuel had to be purchased.

Sale of tobacco.

12. Our 1910 crop of Sumatra realized from 12 annas to 7 annas per pound according to quality. The total amount sold to Madras cigar manufacturers was 13 maunds 15 seers which realized the sum of Rs 587-11, while the cost of production was only Rs. 193 annas 15.

The 1910 fire-cured crop of cigarette tobacco was of fair quality, but it deteriorated through being stored too long on the farm where at that time there was no suitable store-house and it finally had to be disposed of at a nominal figure.

The 1911 crop has now all been disposed of and the prices obtained this year are far ahead of anything previously realized for tobacco grown in this district. In fact, I think, we might venture to say that the prices realized for our Sumatra tobacco this year are probably higher than any hitherto obtained for tobacco grown in India ; but I am open to correction on this point.

The Sumatra grown on $1\frac{1}{16}$ acres in Block B was sorted into four grades according to size and quality of leaves. The three top grades were sold to a Madras firm of cigar manufacturers at the following prices :—

Grade.	Quality.	Price	Rs.	a.
A	862lbs.	at Rs. 1-4 per lb.	=1,077	8
B	256 „	„ „ 1-0 „	„ = 256	0
C	256 „	„ „ 0-12 „	„ = 192	0
Total	1,404lbs.		1,555	8

This works out at an average price of Re. 1-1-8 per lb. for 1,401lbs. of tobacco. The price per maund (of 82lbs.) is as follows for each grade :—

	Rs.	a.	
Grade A	102	8	per maund.
„ B	82	0	„ „
„ C	61	8	„ „

The cost of cultivation and curing of the tobacco sold for Rs. 1,555-8-0 was Rs. 246-9-9 (exclusive of rent of land and value of cowdung).

Our 1911 crop of firecured cigarette tobacco has been sold locally and realized the following prices :—

Variety.	Quantity.	Price.
White Barley ...	5 maunds	at Rs. 37-8 per maund.
Little Flemingen ...	7 „	„ „ 35 „
Connecticut seed leaf	13 „	„ „ 25 „

These prices are satisfactory in view of the fact that the bulk of the tobacco did not grow well owing to poverty of soil and adverse weather conditions. On better soil and under more favourable conditions the quality of the tobacco would have been better and the prices would probably have been correspondingly enhanced.

A small quantity of Turkish tobacco which was successfully fire-cured was sold to a Bombay firm of cigarette manufacturers at the following prices :—

1st quality	...	19 seers at Rs. 81-4 per maund.
2nd „	...	28 „ at „ 50 „

The above figures indicate that during the last two years considerable progress has been made towards the attainment of our object. It may be argued that the high prices obtained for our Sumatra leaf are mainly due to the import duty on tobacco, and this is no doubt true to a certain extent, but the fact remains that the tobacco was found by manufacturers of Indian cigars to be suitable for their purposes, as otherwise they would not have purchased it whatever the import duty might be.

Valuation of samples sent to England.

13. Samples of our 1910 crop of tobacco were sent to the Imperial Institute, London, for report and valuation. The full report by Professor Dunstan, Director of the Imperial Institute, will be found in the appendix to this report. Although this report is distinctly more favourable than any

we have received hitherto from England, yet it appears that considerable improvement will have to be effected in the quality of our tobacco before it can compete with tobacco already on the English market. We are not, however, inclined to be discouraged by this fact, as we have already found a market in India for our better grades of cigar and cigarette tobacco, and there is reason to hope that in time we shall be able to produce grades of tobacco which will be acceptable to the English market.

Samples of our best cigar and cigarette tobaccos of the 1911 crop have also been sent to the Imperial Institute and their report is now awaited.

Oats.

14. About 6·16 acres of the local variety were grown on Block A and a portion of Block B. Both plots of land were green-manured in the preceding rains, Block A with *dhaincha* and Block B with cowpeas.

The soil of Block A is extremely poor and uneven. The crop grew well in patches, but the total yield was poor. On 1 *bigha* of land which received a dressing of 10 maunds of lime per acre in the previous spring the oats made slightly better growth. On Block B the crop did well, but wet weather at the time of harvest seriously interfered with threshing operations and in consequence it was only possible to thresh a portion of the crop. The rest was cut and fed to the farm cattle.

A mixed crop of oats and peas for fodder was sown on 4⅓ acres in Block D for fodder. The peas died off soon after germination and the growth of the oats was poor. About 67½ maunds of green oats were cut and fed to the cattle.

Mustard.

15. About 8·9 acres of the local variety was grown on Block E. The land was green-manured with cowpeas in the preceding rains. The growth of the crop was stunted and patchy and the yield only amounted to 7 maunds of seed. The oil content of the seed was reported to be very low.

Wheat.

16. Pusa No. 4 was grown for comparison with the local variety on plots $\frac{1}{15}$ acre in area in Block E. The land had been previously green-manured with cowpeas. The soil is evidently not suited to the crop, as the Pusa variety practically failed, while the growth of the local variety was very stunted. The former yielded only 1 seer of grain and the latter 7½ seers.

17. An experiment was made to compare the following varieties—Darjeeling, Silbilaiti (local) Magnum Bonum and King of Potatoes (from the Khasi Hills). These varieties were grown alternately on small beds, in order to, as far as possible, eliminate the error due to the unevenness of the soil. The land which is poor and very sandy was green-manured with cowpeas in the preceding rains and in addition received a dressing of 150 maunds of cowdung per acre applied shortly before the potatoes were planted.

Potatoes.

The results of the experiment are shown in the following table:—

Variety.	Area.	Actual yield.	Yield per acre.
1	2	3	4
		Md. s. ch.	Md. s. ch.
Darjeeling	·10 acre ...	11 39 8	119 35 0
Silbilaiti	·10 „ ...	8 19 8	84 35 0
Magnum Bonum ...	·08 „ ...	5 0 0	62 20 0
King of Potatoes	·06 „ ...	3 22 8	59 16 0

The Darjeeling variety is easily first as far as yield is concerned, but it is unfortunately much more liable to disease than the local variety. The two varieties from the Khasi Hills gave poor yields and were also found to be badly diseased. A rough estimate of the extent to which each variety was diseased was obtained by cutting open a certain number of tubers. The Silbilaiti variety was found to be free from disease while the Darjeeling variety had 10 per cent., King of Potato 20 per cent., and Magnum Bonum 30 per cent. diseased.

A number of local cultivators visited the Farm to see the crop lifted. They were much impressed by the size and appearance of the Darjeeling variety as compared with that of the local, but in view of the fact that the local variety is more free from disease and also a better keeping potato, I doubt whether it would be profitable for them to discard it in favour of the Darjeeling variety.

The same four varieties of potatoes were grown non-experimentally in odd pieces of land in Block B. The land was manured in the same way as for the experiment. The results were as follow :—

Variety.	Area.	Actual yield.		
1	2	3		
	Acre.	Mds.	sr.	ch.
Darjeeling	·39	56	35	8
Silbilaiti	·30	24	34	8
Magnum Bonum	·08	5	0	0
King of Potatoes	·06	3	22	8
Total	0·83	90	12	8

Cowpeas.

18. This crop was grown for green manure on 23·64 acres in Blocks B, D and E. The growth was good except on very sandy patches of soil. The crop was ploughed in during July and August and became thoroughly well rotted before the *rabi* crops were sown. The effect of green manuring with cowpeas on this sandy soil has been very marked, especially in connection with the improvement of the water retaining capacity of the soil. The raiyats in the vicinity have begun to recognise this, and there is now a small demand for cowpea seed for green-manuring purposes.

Dhaincha.

19. The crop was grown for green manure on nearly 5 acres in Block A, but the growth was extremely poor and uneven owing to the poverty of the soil. It was ploughed under in August.

Jear.

20. This crop was grown for fodder in Block C and a portion of Block C, the total area being about $1\frac{1}{10}$ acre. The crop made remarkably good growth, the outturn of green fodder obtained for the cattle being 463½ maunds. A portion of the crop which got too old and woody for cattle feed was used as fuel for the

fire curing of tobacco. The Farm Superintendent has been able to induce several local raiyats to put down small areas of this crop for fodder.

Euchlaena Mexicana.

21. An Australian fodder crop tried for the first time in this locality. It is very similar in appearance and habit of growth to *joar*. About 34½ maunds of green fodder were obtained from a little less than $\frac{1}{10}$ acre of land. A small area was also grown for seed. The crop is being grown on a larger area this year.

Ground nut.

22. This crop was tried for the second time. About $\frac{1}{10}$ acre was sown in Block *D* in three instalments, one in May, one in August, and the other in September, in order to discover what season would be best for sowing. The land was manured with 150 maunds of cowdung per acre.

The earlier sowing made better growth than the later sowings, but the plants were attacked by the Bihar hairy caterpillar. The yield of nuts was very small and the crop was practically a failure.

A small plot of Bambara ground nut was tried for the first time on this farm, but the results were disappointing.

Aus paddy.

23. A local coarse variety called *goria* was grown on 7·2 acres in Block C. The crop made too much vegetative growth for a high yield of grain, the total yield of paddy being about 60½ maunds.

The *aus* crop was followed by *matikalai* which was badly attacked by the Bihar hairy caterpillar. About an acre of the crop was partially saved by isolating it with deep trenches and picking off the caterpillars, but the remainder of the crop had to be ploughed in.

Distribution of seed.

24. The following quantities of seed were distributed from the Farm during the year :—

Tobacco	...	...	...	7 ounces.
Oats	...	...	...	2 maunds.
Joar	...	...	...	7¼ seers.
Dhaincha	...	...	...	5½ „
Cowpea	...	...	...	3 maunds 25 seers.
Potato (Darjeeling)		...	...	35 seers.

Improved implements.

25. The Planet Junior Hand Hoe and the Hindustan plough were in constant use and did satisfactory work. A full report on the working of these implements was given in last year's annual report of this farm.

Receipts and expenditure.

26. The receipts during the year amounted to Rs. 907-10-6 and the total expenditure to Rs. 11,723-12-4, of which Rs. 4,735-13-5 was spent on account of capital charges and Rs. 2,630-7-6 for establishment.

Establishment.

27. The establishment consists of a Farm Superintendent on Rs. 100—10—200, a Fieldman Clerk on Rs. 25—1-8—40 and a Darwan on Rs. 8 per mensem. With regard to the work of the staff I need only say that the actual carrying out of the experiments rests almost entirely with the Farm Superintendent and any success attained in our work with tobacco has been mainly due to his efforts.

Inspection.

28. His Honour the Lieutenant-Governor visited the Farm once with the Commissioner of the Division. The Farm was inspected once by the Officiating Director of Agriculture, once by the Director of Agriculture, four times by the Deputy Director of Agriculture, once by the Economic Botanist, and once by the Collector of Rangpur during the year.

Large numbers of raiyats from the surrounding country came in frequently to see the experiments. The Farm being close to a market place is conveniently situated for inspection by the raiyats of the neighbourhood.

A. G. BIRT.

APPENDIX.

Report received from Professor Dunstan, Director, Imperial Institute, London, on the result of the examination of tobacco.

"The samples were eight in number and were labelled "A" to "H". Their descriptions together with the results of examination at the Imperial Institute are given below :—

(*A*) "*Sumatra; Shade-cured*".—This sample weighed 10¼ lbs. and consisted of 19 hands of fairly large leaves, averaging 20 by 8 inches, which were of even, rather bright brown colour, and fine texture. Some of the leaves showed green patches, but they were generally free from blemishes. The midribs were rather prominent, and "winged".

The tobacco burnt fairly well, leaving a dark ash.

(*B*) "*Sumatra; Shade-cured*".—Weight 10½ lbs. This sample consisted of 22 hands of leaves averaging 18½ by 9¼ inches. The tobacco was of fine texture, and of fairly even nut-brown colour with a few leaves of lighter tint. The midribs were rather prominent, and "winged".

The tobacco burnt fairly well, and rapidly, but left a dark grey ash. It was analysed with the following results :—

	Per cent.
Moisture	13·4
Nicotine	2·0
Total nitrogen	1·8
Ash	17·8

The ash contained :—

		Per cent.
Lime	CaO	23·10
Magnesia	MgO	5·61
Potash	K_2O	23·28
Soda	Na_2O	2·46
Sulphuric acid	SO_3	1·37
Chlorine	Cl	0·46

(*C*) "*Sumatra; Shade-cured*".—Weight 10¼ lbs. This sample comprised 24 hands of pale nut-brown leaves averaging 16 by 5½ inches. The midribs were prominent and "winged".

The tobacco burnt rather sluggishly, leaving a grey to black ash.

(*D*) "*Sumatra; Shade-cured*".—Weight 9¼ lbs. This sample was in poor condition, the leaves being crushed and torn. It consisted of 18 hands of leaves of medium brown colour and rather fine texture. A few leaves showed greenish unfermented patches. The midribs were prominent and "winged". The leaves averaged 16½ by 8 inches.

The tobacco burnt rather sluggishly, leaving a grey ash with patches and spots of white.

(*E*) "*Connecticut seed leaf, Flue-cured*".—This sample weighed 9 lbs. and comprised 23 hands of "bright" leaves, of light yellow colour with a greenish tinge. The leaves averaged 21 by 7 inches. They were in good condition, with very few spots or blemishes. The midribs were small and "winged".

The tobacco burnt well and fairly quickly, leaving a light grey ash. It was analysed with the following results:—

	Per cent.
Moisture	15·1
Nicotine	2·2
Total nitrogen	1·3
Ash	14·8

The ash contained:—

		Per cent.
Lime	CaO	25·82
Magnesia	MgO	4·53
Potash	K_2O	18·35
Soda	Na_2O	1·20
Sulphuric acid ...	SO_3	1·44
Chlorine	Cl	0·18

(*F*) "*Connecticut seed leaf; Shade-cured*".—Weight 10 lbs. This sample consisted of 15 hands of pale yellowish-brown tobacco of papery texture. A few greenish-brown leaves were present. The leaves averaged 17½ by 6½ inches. The midribs were not too prominent, but were "winged".

The tobacco burnt fairly well, but slowly, and left a dark grey ash. It was analysed with the following results:—

	Per cent.
Moisture	13·3
Nicotine	2·8
Total nitrogen	2·0
Ash	16·1

The ash contained :—

		Per cent.
Lime	CaO	27·54
Magnesia	MgO	4·92
Potash	K_2O	20·68
Soda	Na_2O	1·84
Sulphuric acid	SO_3	1·72
Chlorine	Cl	0·24

(*G*) *Bhengi* (*local variety*); *Shade-cured.*—Weight 9¾lbs. This sample comprised 19 hands of leaves, which averaged 17 by 9 inches, and were of fairly even dull brown colour. A few leaves showed patches of green and darker brown but the sample was generally free from blemishes. The midribs were rather prominent, but not "winged."

The tobacco burnt well, but left a black ash.

(*H*) *Bhengi* (*local variety*); *Shade-cured.*—This sample weighed 9¾ lbs. and consisted of 18 hands of leaves averaging 17 by 9½ inches. The condition was good and the sample resembled the preceding sample G in general character, though the colour of the leaves was darker and the midribs were more prominent.

The tobacco burnt well, but left a dark grey ash, edged with black.

Commercial valuation.—The samples were submitted to several firms of tobacco manufacturers and merchants, who reported as follows on their properties and commercial value :—

(1) One firm considered that these tobaccos could not be remuneratively exported to Europe, but might find a market in India. Sample A, being of a "silky" nature, might be used for covering Indian cigars. The firm drew attention to the unduly large proportion of stalks and midribs in the samples, but they added that the tobaccos had been handled well and were in good condition. They considered the smoke from these tobaccos to be like that from immature leaves and to be lacking in aroma.

(2) A second firm expressed similar views regarding the unsuitability of the samples for export, unless the growth was considerably improved. They stated that the tobacco had a somewhat unpleasant odour when burnt, although possessing the good property of burning freely. The firm added that the leaves of samples A, B, C and D were too narrow for cigar wrappers, and were also not of a colour suitable for this purpose.

(3) A third firm reported that these tobaccos show considerable promise, although they would not have much commercial value in the United Kingdom in their present condition.

(4) A fourth firm stated that there would probably be a good market in the United Kingdom for these tobaccos if sent over in good dry condition. Since, however, they represent a new growth of tobacco their full value is not likely to be obtained at the outset, and they would have to be offered at about the following prices in order to attempt buyers :—

Sample.	Price per lb. in London warehouse
A and B	6*d.* to 6½*d.*
C	4½*d.*
D	5½*d.*
E and F	5*d.*
G and H	4½*d.*

The firm mentioned that the leaves of samples A to F were rather too thin and narrow, whilst G and H might be a little stouter and longer, and should also be "butted," *i. e.*, the stalk cut off up to the leaf. They stated that the samples were in good order, with the exception of E, which was soft and, if packed in this condition, might become heated and greatly deteriorate in value during transit.

This firm also expressed a wish to receive consignments of about 10 bales of each of these tobaccos in order to test the market. They considered, however, that grades A and B could be packed together, and also grades G and H.

(5) A firm to whom samples E and G were submitted as possibly suitable for the preparation of light pipe tobaccos valued them at 5*d.* and 6*d.* per lb., respectively, and added that sample E would be more valuable but for its peculiar flavour when smoked, which might be objected to.

(6) Another firm were of opinion that the tobaccos were unsuitable for cigars but would make satisfactory pipe tobacco, for which purpose the light-coloured samples would be worth up to about 9*d.* per lb. and the darker samples about 5*d.* per lb.

General conclusions and recommendations.—The analyses quoted above show that these tobaccos from Burirhat are of fairly satisfactory composition. The quantities of nitrogen and of nicotine are, if anything, too low, and this may partly explain the fact that the smoke produced on burning the tobaccos is lacking in character, pungency and aroma.

This, however, is also in part due to under-fermentation of the tobaccos, as shown by their light colour, and it is possible that better fermentation may give a tobacco which will produce a more aromatic and characteristic smoke. In the ensuing year more attention should be given to the fermentation with the object of solving this problem.

The precentages of moisture are a little high in some cases for tobacco intended for export to the United Kingdom. For such purposes the proportion should be kept down to 12 to 13 per cent. which will allow of drying down to about 11 per cent. during transit. The amount of moisture in the tobacco is of course a very important matter in exporting to a country such as the United Kingdom, where the duty on tobacco is high.

The least satisfactory feature on the present samples is the dark colour of the ash left on smoking the tobacco. The dark colour is curious in view of the large percentage of potash and the relatively small amounts of sulphates and chlorides present, since it is generally believed that good burning in tobacco depends mainly on the presence of a fair quantity of potash in the ash and the practical absence of chlorides and sulphates. The results obtained with these tobaccos, however, confirm previous experience at the Imperial Institute in showing that the presence of a considerable quantity of lime in the ash is desirable, if the latter is to be of light colour. In the present samples the percentage of lime in the ash ranges from 23 to 27, whereas in good cigar tobaccos it is often as high as 40 per cent. or more. In this connection it is noticeable that the soils in which these tobaccos were grown were all deficient in lime, and it will be interesting to see whether tobacco of better burning quality is obtained as the results of the proposed application of lime to these soils.

In the descriptive list supplied to the Imperial Institute, samples E and G from Connecticut and "Bhengi" seed, respectively, are suggested as cigarette tobaccos, presumably as substitutes for "Virginian Cigarette tobacco." In this connection it should be noted that if cigaretto tobaccos of the Virginian type are to be produced, the seed of suitable varieties from the United States should be tried at Burirhat. The varieties so far experimented with, *viz.*, Sumatra, Connecticut seed leaf, and "Bhengi," are typical cigar tobaccos and are not likely to give large enough yields of leaves of the right type to be used for the production of cheap

"bright" cigarette tobaccos for export. A list of varieties of "bright" tobacco suitable for this purpose is given in the "Bulletin of the Imperial Institute," Volume VIII (1910), No. 2, and some of these should be tried at Burirhat. The leaves of these varieties should be flue-cured ((*loc. cit.*) for the production of "bright" tobacco.

If attempts to produce cigar tobacco are also to be continued, it would seem to be advisable to try a few other types of this sort, such as Java, Manilla, Brazilian, and Zimmer's Spanish, with a view to the selection of a type better suited to the district than Sumatra and Connecticut leaf appear to be.

As regards the opinion of one firm of commercial experts quoted above, that the materials under report could only be used for pipe tobacco, it should be noticed that this does not imply that these types of leaf are really suitable for the production of pipe tobacco, but merely that their smoke is so lacking in character and aroma that they could only be used for blending with other tobaccos in cheap "smoking mixtures." The tobaccos, with the exception of "E," which has been flue-cured, are all essentially of cigar type, and if experiments with these sorts are continued it should be with the object of producing cigar tobaccos. If pipe tobacco is to be grown, the seed of pipe varieties should be imported for trial."

ANNUAL REPORT ON THE RAJSHAHI AGRICULTURAL STATION FOR THE YEAR ENDING ON 30TH JUNE 1911.

Introduction.

The Farm which has been in existence since 1901 was handed over to this province at the time of the Partition of Bengal. It is situated just outside the town of Rampur-Boalia. Its total area is 63 acres, of which about 50 acres is under cultivation. About half of the area is lowland suitable for the growth of winter rice, while the remainder is highland suitable for the ordinary dry crops of the district. The soil of the lowland is stiff, while that of the highland varies from sandy loam to loam. Analysis has shown the soil to be rich in lime, but somewhat deficient in phosphates and potash.

The lowlands are liable to disastrous floods from the Ganges and to water-logging for want of an outlet to carry off the rain water. These and other causes combined to render practically every experiment made in the year under report a failure.

2. In view of the fact that a considerable portion of the land will be taken up for the construction of a railway it is proposed to abandon the place as an Experiment Station. If the drainage can be put right at a reasonable expenditure it is probable that the remainder of the land will be used for demonstration purposes by the District Agricultural Officer when appointed.

Programme of experiments.

3. The following experiments referred to in the last two reports of this Station were continued. They included :—

(1) Winter paddy ... (*a*) Manurial trials. (*b*) Planting Experiments. (*c*) Variety tests.

(2) Jute ... (*a*) Manurial trials. (*b*) Rotation Experiment.

(3) Sugarcane ... ... Variety trials.

(4) Trial of groundnuts. In addition to the above an experiment was started to test the effect of using sprouted sugarcane sets as against non-sprouted. Two varieties of aus paddy were also grown for comparison.

Winter paddy.

4. Manurial trials.—With the object of testing the residual value of the manures applied in the previous year, winter paddy was grown without manure on all the plots in the two manurial series mentioned in last year's report.

The results are disappointing, none of the manured plots giving an appreciable increase in yield over the average of the unmanured plots.

The result of the experiment however cannot be considered reliable, as in all cases the yields were much below the average, the growth of the plants having been adversely affected by excessive water-logging in the rains.

The planting experiments which were commenced in 1909 were intended to duplicate those being carried out at Dacca. The experiment was continued during the year under report. The yields were rather better than those in the manurial experiments, but the figures obtained do not give any conclusive result.

In the variety tests four varieties, *viz.*, Badshabhog, Kartaribhog, Elai and Gajia were grown for comparison on duplicate $\frac{1}{10}$ acre plots. The yields in each case were poor, but Badshabhog gave about 3 maunds per acre less grain than did each of the other varieties.

Jute.

5. The experiment to test the residual value of cowdung and castor cake applied in 1908 and the rotation experiment referred to in last year's report were continued, but the yields on all the plots were so low owing to defective germination and water-logging that it is impossible to accept the results.

Sugarcane.

6. The following varieties were grown in two series of plots. In one series the plots were $\frac{1}{8}$ acre in area and in the other $\frac{1}{10}$ acre Vandamukhi, Samsara, Ganderi and local Khagri.

Owing to dry weather at the time of planting the germination was very uneven and consequently very little value

can be attached to the results. In the $\frac{1}{10}$ acre series the yields of gur per acre were as follows:—

Vandamukhi	...	...	125	Maunds.
Samsara	...	...	93	"
Ganderi	...	...	52½	"
Khagri	...	...	56	"

and in the ½ acre series

Vandamukhi	...	...	35¾	Maunds.
Samsara	...	...	17½	"
Ganderi	...	...	58	"
Khagri	...	...	57	"

An experiment on duplicate plots to test the effect of sprouting sets before planting against planting sets direct into the field gave an average result in favour of sprouted sets, the average yields of gur per acre being 76 maunds from sprouted sets against 71 maunds from non-sprouted sets; but this result is practically negatived by the fact that one of the non-sprouted plots gave a higher yield of gur than either of the sprouted plots.

Ground nuts.

7. This crop was tried for the third time. It germinated well and gave every promise of success, but was eventually destroyed by water-logging during the rains.

Aus paddy.

8. Two varieties, *viz.*, Surjamukhi and Kashiapanja, were grown on ½ acre duplicate plots for comparison.

The average yield of Kashiapanja on the two plots was 19 maunds of grain while that of Surjamukhi was only 13½ maunds per acre.

Receipts and expenditure.

The total receipts amount to Rs. 1,440 and the expenditure to Rs. 6,379, including Rs. 2,409 for establishment and Rs. 92 for capital charges.

Inspection.

10. The Director of Agriculture and the Fibre Expert each visited the farm once and the 2nd Deputy Director twice during year.

— MAP —
— OF —
— BURIR HAT FARM —

EX. OVERSEER

ANNUAL REPORT ON THE JORHAT AGRICULTURAL STATION FOR THE YEAR ENDING THE 30TH JUNE 1911.

Introduction.

This station, established in the beginning of the year 1906, is intended principally for the investigation of sugarcane. It is situated about 3 miles south of Jorhat town. Its total area is 35½ acres, of which 1·7 acres is *hola* or ravine land, which has been cropped with winter rice for many years, and the remainder is high land, which was under grass and light scrub jungle before it was acquired.

Soil.

2. The soil of the high land is a reddish sandy loam belonging to the old alluvium. This class of soil is typical of considerable tracts in the Assam Valley which are cropped with sugarcane to some extent.

Four samples of soil and four of sub-soil have been analysed by the Imperial Agricultural Chemist, Pusa. A detailed statement of the analyses was tabulated in a previous year's report, so it will probably be sufficient to give here an extract of Dr. Leather's remarks.

"There is a great uniformity among these soils, and no appreciable difference exists between any of them. They are all deficient in lime. The amount of organic matter as indicated by the organic carbon and nitrogen is higher than is common to Indian soils. Although there is abundance of potash, the available portion is very small and that of available phosphate is also very small. The mechanical analysis shows the soil to consist almost entirely of moderately fine sand."

Buildings.

3. The farm is equipped with a godown, combined office and rest-house for inspecting officers, quarters for Farm Superintendent, and a cattle-shed with brick walling and a corrugated iron roof.

During the year quarters were erected for two apprentices at a cost of Rs. 125 each.

4. The rainfall recorded during the growth of the crops referred to is given in the following table side by side with the normal rainfall :—

Rainfall.

Month.		Actual rainfall in inches.	Normal rainfall in inches.
	1	2	3
1910	April	5·18	8·54
„	May	9·13	9·26
„	June	9·37	11·36
„	July	15·65	14·76
„	August	15·64	15·15
„	September	9·51	9·18
„	October	7·51	4·07
„	November	0·71	0·69
„	December	Nil	0·52
1911	January	4·85	0·93
„	February	0·88	1·32
„	March	5·52	3·90
	Total	83·95	79·68
1911	April	10·96	8·54

The season was on the whole a normal one, the rainfall being well distributed. Excessive rain during the first part of April 1911 was somewhat detrimental to the plant sugarcane which was then about ripe. The variety which suffered most was Magh which became swollen with moisture with the result that the juice was extremely poor in sugar.

Experimental work.

5. The experiments described in last year's report were continued on similar lines, the chief items being :—

I. Variety trials with plant and ratoon sugarcane.

II. Experiment with lime.

III. Trials of groundnuts and potatoes.

Ratoon sugarcane.

6. In last year's report results of trials with 14 varieties of cane planted in Block D in 1909 were recorded. Of these fourteen varieties the following were ratooned :—

1. Striped Mauritius.
2. B. 147.
3. B. 1753.
4. B. 376.
5. Striped Tana.
6. Teli.
7. Kheri.
8. Vandamukhi.
9. Magh.

Of the remaining varieties, Samsara, Dacca Ganderi and Bagapura made such wretched growth that it was decided not to ratoon them, while Pounda and B. 208 were so badly attacked by red rot that it was considered advisable to root up the plants and burn them. All the above except B. 208 have since been rejected from further trials. The ratoon crop of Magh was poor and so badly attacked by disease that it was not considered worth crushing experimentally. The results of the ratoon crop are therefore given for only 8 varieties.

After the removal of the first crop of cane, all refuse was removed from the plots and the land was hoed. Two earthings were given, one during the first week of July and the other in the first week of August. All the plots were given a dressing of 20 maunds of Rape cake per acre, half at the time of the first earthing and half at the second earthing. Beyond the occasional removal of dead leaves and diseased canes no other cultivation was given. The cane was harvested from January 28th to February 5th.

The results of the 8 varieties are set out in tables I, II, III and IV. Table I gives the analyses of the juice, and table II the weights of cane, juice and sugar per acre, etc. Table III compares the composition of the juice with that of the gur obtained from it, and Table IV gives the numbers of canes fit and unfit for crushing.

TABLE I.

Ratoon cane, 1910-11.

Variety.	Area actually weighed and analysed.	Juice.					
		Cane sugar.	Glucose.	Total sugar.	Glucose ratio.	Total solids.	Purity coefficient.
1	2	3	4	5	6	7	8
		Per cent.	Per cent.	Per cent.		Per cent.	
B. 376	$\frac{1}{10}$ acre ...	17·76	0·27	18·03	1·52	18·8	94·4
B. 147	$\frac{1}{8}$ „ ...	17·23	0·37	17·60	2·14	18·6	92·6
Striped Mauritius ...	$\frac{1}{10}$ „ ...	16·00	0·64	16·64	3·99	17·3	92·4
B. 1753	$\frac{1}{10}$ „ ...	15·42	0·67	16·09	4·34	17·2	89·6
Vándamukhi ...	$\frac{1}{10}$ „ ...	15·12	0·79	15·91	5·22	17·4	86·9
Téli	$\frac{1}{10}$ „ ...	13·96	2·06	16·02	14·74	16·9	82·6
Striped Tana ...	$\frac{1}{10}$ „ ...	13·48	1·39	14·87	10·30	16·2	83·2
Kheri	$\frac{1}{10}$ „ ...	12·41	2·06	14·47	16·58	16·0	77·6

Glucose ratio=Parts of Glucose per 100 parts cane sugar.

Purity Coefficient=Cane sugar per cent. of total solids.

The above figures demonstrate the superiority of Striped Mauritius, B. 147 and B. 376 in respect of quality of juice. All these varieties give a high percentage of cane sugar, a low glucose ratio and a high purity coefficient.

TABLE II.

Ratoon Cane, 1910-1911—*Per acre.*

Variety.	Area actually weighed.	Yield of cane.	Yield of juice.	Percentage juice on cane.	Total sugar per cent. on juice.	Total sugar per acre.	Gur per acre.
1	2	3	4	5	6	7	8
	Acre.	lb.	lb.			lb.	Mds. srs.
Striped Mauritius ...	1/10	69,760	45,240	64·9	16·64	7,528	84 25
B. 376	1/10	57,200	37,720	65·9	12·03	4,801	81 5
B. 147	1/4	55,840	38,584	69·1	17·60	6,791	84 4
Striped Tana	1/8	65,008	41,776	64·2	14·87	6,212	84 30
Kheri	1/10	56,780	36,620	64·5	14·47	5,299	70 27
B. 1753	1/10	49,100	31,620	64·4	16·09	5,086	68 0
Teli	1/8	49,160	31,200	63·4	16·02	4,996	67 10
Vandamukhi	1/10	37,840	25,800	68·2	15·91	4,105	53 17

In respect of total yield of sugar per acre Striped Mauritius is first followed by B 376 and B 147. These varieties combine a high yield with superior quality of juice. Striped, Tana and Kheri also shew a high yield of cane and juice, but by reason of the inferior quality of their juices the yield of sugar per acre is considerably less.

TABLE III.

Ratoon cane, 1910-1911.

Variety.	Cane sugar in juice.	Cane sugar in gur.	Glucose in juice.	Glucose in gur.
1	2	3	4	5
	Per cent.	Per cent.	Per cent.	Per cent.
B. 376	17·76	85·34	0·27	2·95
B. 147	17·23	79·44	0·37	5·50
Striped Mauritius ...	15·00	80·32	0·64	6·50
B. 1753	15·42	78·54	0·67	4·90
Vandamukhi ...	15·12	74·92	0·79	6·20
Striped Tana ...	13·48	74·28	1·39	9·00
Teli	13·96	72·34	2·06	12·60
Kheri	12·41	68·14	2·06	13·90

The above table shews how the quality of the "gur" is related to the composition of the juice. Striped Mauritius and the Barbadoes varieties with high quality juices produce much better quality "gurs" than do Kheri, Teli and Striped Tana which give juices of low quality.

TABLE IV.

Ratoon Cane, 1910-1911—*Per Plot.*

Variety.	Area crushed.	Number of canes fit for crushing.	Number of canes unfit for crushing.	Per cent. fit for crushing.	Per cent. unfit for crushing.
1	2	3	4	5	6
	Acre.				
B. 147	$\frac{1}{5}$	1,929	33	98·3	1·7
Striped Tana ...	$\frac{1}{15}$	844	16	98·1	1·9
B. 376	$\frac{1}{20}$	804	20	97·6	2·4
Vandamakhi	$\frac{1}{30}$	1,033	40	96·3	3·7
B. 1753	$\frac{1}{25}$	968	41	95·9	4·1
Striped Mauritius ...	$\frac{1}{20}$	974	45	95·5	4·5
Teli	$\frac{1}{30}$	1,173	90	92·9	7·1
Kheri	$\frac{1}{25}$	1,945	230	89·4	10·6

This table gives the proportion of canes fit for crushing on the date of harvesting. It must not be taken however as a strict comparison of the disease resisting powers of the various varieties, as we periodically remove all dead canes during the growing season. The principal causes of the destruction of canes at Jorhat are red rot, borer and white ants, while jackals also damage the cane to some extent. As the destruction of canes is due in many cases to two or more of the above causes it is difficult to give anything but an approximation of the extent of the damage done by each pest, so this year figures have been omitted.

The principal pest of Kheri was borer, of Teli borer and white ants, of Striped Mauritius borer, white ants and red rot, of Striped Tana borer and white ants, and of B1753 red rot.

Plant cane.

7. The following varieties were grown on Block E (*vide* plan) :—

1. Striped Mauritius ...		¼ acre plots.
2. Tana	½ plot striped	
	½ plot yellow	
3. Magh		
4. Kheri		
5. B.147		$\frac{1}{10}$ acre plots.
6. B.1753 ...		
7. B.376		
8. B.208		
9. Teli		
10. Vandamukhi ...		

The land was given a dressing of 30 maunds of slaked lime per acre in the spring of 1909 and was green manured with cowpeas in the following rains. It remained fallow in the cold weather of 1909-1910.

Well rotted cowdung at the rate of 500 maunds per acre was ploughed in about a month before planting. The sets, which had been all previously sprouted in seed beds were planted out in the field during the first week of May 1910. Subsequent cultivation consisted of hoeing, weeding and earthing. The first hoeing was given at the beginning of June and the second at the beginning of July. The crop was earthed twice, once during the first week of August and again in the first week of September. Stripping was done during the first part of November. Diseased canes were removed and destroyed periodically throughout the season.

The crop was harvested and crushed between the 9th and 24th of April 1911. The results of the trials are set out in the following tabulated statements. Table V compares the quality of the juice, Table VI the yields of cane, juice and sugar per acre, etc., and Table VII gives the proportions of canes fit and unfit for crushing at the time of harvest.

TABLE V.

Plant cane, 1910-1911.

Variety.	Area of plot.	Area actually weighed and analysed.	Juice.						Remarks.
			Cane sugar per cent.	Glucose per cent.	Total sugar per cent.	Glucose ratio.	Total solids per cent.	Purity coefficient.	
1	2	3	4	5	6	7	8	9	10
B.147	$\frac{1}{10}$ acre ...	$\frac{1}{10}$ acre ...	18·50	0·23	18·73	1·2	19·6	94·3	
B.208	$\frac{1}{10}$,, ...	$\frac{1}{10}$,, ...	17·32	0·40	17·72	2·3	18·5	93·6	
Striped Mauritius	$\frac{1}{4}$,, ...	$\frac{1}{4}$,, ...	17·25	0·29	17·54	1·6	18·2	94·7	
B.376	$\frac{1}{10}$,, ...	$\frac{1}{10}$,, ...	17·14	0·12	17·26	0·7	18·0	95·2	
Vandamukhi	$\frac{1}{10}$,, ...	$\frac{1}{10}$,, ...	15·20	0·54	15·74	3·5	17·1	88·3	
Teli...	$\frac{1}{10}$,, ...	$\frac{1}{10}$,, ...	14·98	1·01	15·99	6·7	17·2	87·0	
Yellow Tana	$\frac{1}{4}$,, ...	$\frac{1}{4}$,, ...	14·76	0·55	15·31	3·7	17·6	86·8	
B.1753	$\frac{1}{10}$,, ...	$\frac{1}{10}$,, ...	14·68	0·48	15·16	3.2	16·3	90·0	
Striped Tana	$\frac{1}{4}$,, ...	$\frac{1}{4}$,, ...	13·57	0·97	14·54	7·1	16·1	84·2	
Kheri	$\frac{1}{4}$,, ...	$\frac{1}{4}$,, ...	12·80	1·02	13·82	7·9	15·4	83·1	
Magh	$\frac{1}{4}$,, ...	$\frac{1}{4}$,, ...	12·09	1·25	13·34	10·3	14·7	82·2	

Here again the superiority of B. 147, B. 376 and Striped Mauritius in quality of juice is strikingly demonstrated, the percentages of cane sugar and the purity coefficient being high and the glucose ratio low. B. 208, which last year had to be destroyed on account of disease, also gives a high quality juice in spite of the fact that it is still very susceptible to attack.

Magh gives the worst quality juice of all the varieties. This is partly accounted for by the fact that this variety was badly attacked by red rot and also suffered considerably from heavy rains just at the final stage of ripening.

TABLE VI.

Plant cane, 1910-1911 (*per acre*).

Variety.	Area of plot.	Area actually weighed.	Yield of cane.	Yield of juice.	Percentage juice on cane.	Total sugar per cent. on juice.	Total sugar per acre.	G ur per acre.	Remarks.
1	2	3	4	5	6	7	8	9	10
			lb.	lb.			lb.	mds. srs.	
Striped Mauritius	½ acre ...	½ acre ...	61,003	39,953	65·5	17·54	7,014	82 25	
B. 147	1/10 ,, ...	1/10 ,, ...	50,000	33,650	67·3	15·73	6,112	69 32	
Magh	½ ,, ...	½ ,, ...	59,040	41,496	70·3	13·34	5,535	70 32	
B. 376	1/10 ,, ...	1/10 ,, ...	51,947	31,365	60·4	17·26	5,413	67 1	
Kharf	½ ,, ...	½ ,, ...	62,672	38,172	60·9	13·82	5,275	64 36	
Striped Tana	½ ,, ...	½ ,, ...	54,743	35,320	64·5	14·54	5,135	67 38	
B. 1753	1/10 ,, ...	1/10 ,, ...	51,127	33,440	65·4	15·16	5,069	65 7	
Yellow Tana	½ ,, ...	½ ,, ...	55,801	32,653	58·3	15·31	4,984	60 26	
B. 208	1/10 ,, ...	1/10 ,, ...	42,947	25,835	60·3	17·72	4,587	53 9*	* This figure is only approximate, as some of the gur was accidently spilt while boiling.
Vandamukhi	1/10 ,, ...	1/10 ,, ...	40,334	25,850	64·1	15·74	4,069	50 36	
Tali	¼ ,, ...	1/10 ,, ...	38,510	23,420	60·8	15·09	33,745	47 13	

In connection with the above figures we would draw attention to the comparatively large areas of cane dealt with. In every case but one, *viz.*, that of B. 1753, the whole plot was weighed and crushed and samples for analysis were taken from the *whole of the juice*. Our aim is to make our figures as reliable as possible by making our plots as large as the area available will permit. We should prefer to make all our plots $\frac{1}{4}$ acre in area, but the land at our disposal is not sufficient to admit of this. Consequently our plan now is to grow the most promising varieties on $\frac{1}{4}$ acre plots and the others on $\frac{1}{10}$ acre plots. When any variety has done sufficiently well on a $\frac{1}{10}$ acre plot it will be promoted to a $\frac{1}{4}$ acre plot. In this way we should be able to obtain results which will hold good for large areas.

It will be seen that Striped Mauritius is easily first as regards the amount of sugar per acre, while B. 147 and B. 376 are also good. Magh shews a high yield of sugar per acre, inspite of the poverty of its juice, by reason of a high yield of juice. Kheri also yields a fair amount of total sugar per acre on account of its high cropping power although its juice is of poor quality.

TABLE VII.

Plant cane, 1910-1911 (*per plot*).

Variety.	Area crushed.	Per plot.		Per cent.	
		Number of canes fit for crushing.	Number of canes unfit for crushing.	Fit for crushing.	Unfit for crushing.
1	2	3	4	5	6
Kheri	$\frac{1}{4}$ acre ...	12,923	107	99·1	0·9
B. 376	$\frac{1}{10}$ „ ...	1,833	23	98·6	1·4
Téli	$\frac{1}{10}$ „ ...	3,081	50	98·4	1·6
B. 147	$\frac{1}{10}$ „ ...	1,739	48	97·3	2·7
Vandamukhi	$\frac{1}{10}$ „ ...	2,863	84	97·1	2·9
Striped Tana Yellow „ ...	$\frac{1}{4}$ „ ...	3,687	168	95·6	4·4
Striped Mauritius ...	$\frac{1}{4}$ „ ...	5,646	303	94·8	5·2
Magh	$\frac{1}{4}$ „ ...	5,407	504	91·5	8·5
B. 1753	$\frac{1}{10}$ „ ...	1,233	141	89·7	10·3
B. 208	$\frac{1}{10}$ „ ...	1,767	333	84·1	15·9

The same remarks apply to this table as were given under Table IV. The principal pest of B. 208 was red rot; of B. 1753, red rot and white ants; of Magh, red rot; of Striped Mauritius, red rot and white ants; of Tana, borer; of Vandamukhi, borer and white ants; of B. 147, white ants and borer; of Teli, borer and white ants; of B. 376, white ants; and of Kheri, borer.

Sugarcane general remarks.

8. This year's results of both plant and ratoon cane clearly demonstrate the superiority of Striped Mauritius in yield of sugar per acre. This variety combines a comparatively high yield of cane per acre with a good quality juice, high in cane sugar and low in glucose content. It is easily propagated and is an exceedingly good ratooner. Two of the Barbadoes varieties, *viz.*, B. 147 and B. 376, are also exceedingly promising. Although not such high yielders as Striped Mauritius, they give juices of very high quality.

Of the other varieties, Kheri and Magh have given fairly high yields, but their juices are of very poor quality. Kheri is a hard thin cane which will give a fair crop under adverse conditions and does not require such careful cultivation as the superior varieties. Magh is the variety largely grown by cultivators in the locality. It gives a fairly good plant crop, but we find that it is very susceptible to disease and is a miserable ratooner.

On the strength of the results of the last three years' experiments we are now able to definitely recommend Striped Mauritius as a variety superior in every respect to Magh in this locality. The two Barbadoes varieties, B. 147 and B. 376, are gradually getting acclimatized and establishing their reputations, and after further testing on a larger scale it is probable that we shall be in a position to recommend them also for general cultivation. From the point of view of the production of refined sugar, Striped Mauritius and the Barbadoes varieties are far superior to any of the others, while Kheri and Teli are the worst.

Lime experiment.

9. This experiment is described in last year's report as having been commenced in 1909. A strip of land (Block G in plan) was divided into two equal parts longitudinally; one part was given a dressing of 50 mds. of slaked lime per acre and the other part remained untreated. Several rabi crops were sowed in strips across both limed and untreated portions. The

result was remarkable; the crops on the untreated portion died off soon after jermination, while those on the limed portion grew fairly well and produced a certain amount of seed.

In 1910 the experiment was continued, no further manurial treatment being given to the land. Aus paddy was grown over the whole area as the kharif crop. The yield was 20 seers of grain and 6 mds. 32 seers of straw on the limed area as against 7 seers of grain and 3 mds. 24 seers of straw on the non-treated area.

This crop was followed by crops of oats, linseed and gram sown in strips across both limed and non-limed portions. The same thing happened as in the previous year, there being absolutely no crop on the untreated area, while the crops grew to some extent on the limed area although the yields were very small.

The actual yields were:—

	Grain.	Straw.
Oats ...	7½ seers. ...	13½ seers.
Linseed ...	2 ,, ...	4 ,,
Gram ...	... ...	10½ ,,

This year half of the limed area has been given a dressing of 6 maunds of bonemeal per acre.

Groundnuts.

10. This crop was tried for the third time on this farm on about 1⅓ acres in Block F. The land received a dressing of 30 maunds of slaked lime per acre in 1909, and was manured with 150 maunds of cowdung per acre before the crop was sown. The nuts were sown in May 25th and harvested in December. The crop grew well, but as in previous years it was damaged to some extent by rats. The total yield of nuts from 1⅓ acres was 31 maunds 22 seers.

Potatoes.

11. Two varieties, *viz.*, Darjeeling and Nainital, were tried on small areas in the kitchen garden. The area under Darjeeling being about ¼ acre and that under Nainital about ¼ acre. The crops were attacked by cut worms and red ants and the yields were small amounting to about 116 maunds per acre of Nainital and 98 maunds per acre of Darjeeling.

Other crops.

12. Cowpeas were grown on Blocks A and B for green manure. The crop made excellent growth.

Aus paddy—Was grown on about 1½ acre of Block C without manure. The yield was poor, amounting to only 5 maunds 8 seers of grain.

Euchlena Mexicana.—An Australian fodder crop was tried on about $\frac{1}{10}$ acre on the kitchen garden. It grew fairly well.

English vegetables including peas, beans, cauliflowers, cabbages and tomatoes were grown successfully in the kitchen garden as in previous years.

Fruit trees.

13. The Lichi trees are now bearing well. Pine-apples are also doing well. Of the other fruit trees guavas, pomelos and custard apples are making good growth, but are not fruiting well. Limes, oranges and mangos are not doing well and are not likely to prove successful.

Receipts and expenditure.

14. The receipts amounted to Rs. 1,820 (chiefly by sale of gur) and the expenditure to Rs. 11,029 including Rs. 1,979 for establishment and Rs. 4,143 for capital charges.

Establishment.

15. The establishment consists of a Farm Superintendent on Rs. 100—10—200, a Fieldman Clerk on Rs. 25—1-8—40 and a peon on Rs. 8.

Two Assamese apprentices completed their period of training on the farm during the year and have since been appointed temporary demonstrators on Rs. 20 per month.

Inspection.

16. The farm was inspected by the Director of Agriculture once, by the Agricultural Chemist and myself each four times and by the first Deputy Director of Agriculture once.

The Deputy Commissioner, Chief Engineer and Post Master General also visited the farm.

Power sugarcane crushing plant.

17. A three roller cane mill 12″ × 18″ driven by a 9 B. H. P. Hornsby Oil Engine was installed on the farm during the year under report.

The sugar mill was purchased from Messrs. Massey & Co., Madras, at a cost of Rs. 1,350 F.O.R., Madras. The Engine was purchased through the same firm at a cost of Rs. 1825 F.O.B., Calcutta.

ANNUAL REPORT OF THE FRUIT EXPERIMENT STATION, SHILLONG, FOR THE YEAR ENDING ON THE 30TH JUNE 1911.

INTRODUCTORY.

Description.

The Fruit Station commenced work in September 1902. It is situated on sloping ground near the village of Umlyngka 3 miles from Shillong, by the side of the Cherrapunji road, nearly midway between the town and Upper Shillong Station. Its elevation is about 5,200 feet, *i.e.*, about 200 feet higher than the town. The total area of the garden is about 15½ acres, of which about three-fourths has been brought under cultivation.

2. The chief object in establishing this garden was to experiment with various kinds of fruit trees which flourish in countries of temperate climates and in produce such as prove successful into general cultivation in the hill districts of this Province.

3. Such fruits as pears, apples, plums and peaches are already grown in and about Shillong, but the fruit in almost every case is of an inferior description.

4. The bulk of the fruit trees were imported from England in the winter of 1902-03 and a few at later dates. Some apples, pears and Spanish chestnuts were obtained in 1902-03 from the Saharanpur Botanical Garden. Cuttings of several varieties of grape vines were obtained in 1903 from Kashmir. Cherimoyers, tree tomatoes and a few other fruits have been propagated from imported seeds. A large number of grafts and cuttings made on the garden have been planted out at various times.

5. The chief difficulty in fruit cultivation in the hill districts of Assam is the heavy rainfall from June to September which destroys much of the fruit and greatly impairs the quality and flavour of the remainder. Fruits which ripen in July or August are naturally the most affected. Attempts are therefore being made to get, in the case of early maturing fruits, still earlier varieties and, in the case of late maturing fruits, still later varieties. Some pears, apples, plums and apricots with the desired characteristics have been ordered from Australia and on arrival will be planted in the most sheltered portions of the garden.

6. Another serious impediment to the successful growing of European fruit at Shillong is the great prevalence of beetles and other insect pests against which few trees or fruits are immuned. The insects breed in the pine forests which form the natural covering of all uncultivated land in the neighbourhood of Shillong and emerge in such countless myriads that all attempts to destroy them are vain. Covering the trees at night with a muslin covered frame has been found by Mr. C. H. Holder to be an efficient safeguard, but the cost is prohibitive to the ordinary gardener. The only practical course for such persons is to maintain their trees in such a state of vigorous health that they can successfully withstand the attacks of the insects. This is also the only means that will enable the trees to resist the growth of the innumerable fungi which flourish in this humid climate and find an easy prey in vegetation which is unhealthy or weak. To this end endeavour is being made to make the trees on the station more hardy by growing them without manure and by following a judicious system of constant pinching of young shoots to induce the formation of fruit only on mature wood.

7. The greater portion of the garden is exposed to the gales which, blowing from the south and west from March to May, knock off the blossom and young fruit. To meet this difficulty shelter belts are being planted; the pinching of shoots should also help the trees to hold their fruit.

8. Besides the fruit trees the garden contains small plantations of strawberries, citrons, Khasi oranges, rhubarb, and asparagus and a large area has been planted with mulberry for the sake of rearing silkworms and also for the supply of plants and cuttings to persons who intend to take up sericulture.

9. An important part of the work of the Fruit station is the propagation of trees and plants for distribution to the public. The garden contains a large number of stocks of wild apple, wild pear, peach and plum which have been planted for this purpose and are ready for grafting when required.

The year's work.

Development.

10. Some new terraces have been made at the upper end of the eastern slope. All the terraces have also been provided with drains and catch pits, where the silt washed out from the soil by rain is allowed to settle and is then taken out and spread on the land.

11. All the pear, nectarine, apple, cherrimoyer and apricot trees and the grape vines were pruned during the winter. The peach trees were pruned once in the summer and again in the winter. With the exception of a small number which showed good vigorous growth all the fruit trees were manured with cowdung in February and March, at the rate of one to three thapas to each plant according to size, the manure being placed in trenches dug under the outer boughs. Towards the end of the year it was decided not to apply manure to the fruit trees in future. Some raspberry canes and current bushes have been planted in trenches filled with a compost of garden soil, vegetable mould and cattle dung. The compost was made in the following proportions:—

Treatment of fruit trees.

40 thapas of vegetable mould from the peak.
40 „ „ cowdung.
80 „ „ garden soil.

The plants are now coming up well.

Some of the cherry and peach trees and all the grape vines and strawberries were sprayed with bordeaux mixture during the winter as a precaution against disease.

12. The strawberry plot (·22 acre) was manured with 4 seers 6 chattacks sulphate of potash, 26 seers of superphosphate, 11 seers saltpetre and 33 maunds cowdung. To the rhubarb plot 156 maunds and to the asparagus 104 maunds, respectively, of cowdung were applied. New beds of these crops are now under preparation and instructions have been given which it is hoped will lead to better results than have previously been attained.

Treatment of other crops.

13. From July to October there was constant heavy rain. From November 1910 till March 1911 the weather was dry; but from the middle of April till the end of June there was rain, often very heavy, almost every day. The winds, however, were less strong than is usual in the spring.

Weather.

14. Owing to the difficulties explained in paragraphs 5-7 no satisfactory results have yet been obtained with apples, pears, plums, cherries, apricots, quinces, nectarines, almonds, grapes, guavas, loquats or cherimoyers. All of these except the loquats and quinces set some fruits, but most of them were knocked off by the wind and rain and the few that survived were of poor quality. The peach trees did not

Results of fruit trees.

yield well, but some good samples of Early Silver and Dr. Hogg were picked. Most of the fig trees have died, but one was bearing a good crop at the end of the year. Thirty-seven seers of Spanish chestnuts were obtained from the old trees at Upper Shillong. The mountain papaya trees have died; apparently the stock of these and of tree tomatoes needs to be frequently renewed. Some of the mountain papayas are bearing fruit. The walnut and orange trees are not of age for fruiting, but several of the citrons are carrying a fairly good crop this year. A hybrid raspberry brought from Panchmari has fruited, but the fruit is no better, though very similar to the wild Khasi raspberry.

In Appendix A a list is given of the fruit trees at this station and of the number of grafts available for distribution.

Results of other crops.

15. A small profit was obtained from the cultivation of rhubarb and asparagus, but strawberries failed to repay the heavy expense incurred in manuring. To some extent these unsatisfactory results are due to lack of efficient supervision. Knowing that Government was considering a proposal to abandon the Fruit Station, it is natural that the staff took little interest in looking after it.

Propagation and distribution.

16. Besides the grafting and budding of fruit trees, seedlings and cuttings of rhubarb, asparagus, mulberry, etc., are propagated and sold or distributed. A statement of the quantity issued during the year is given in Appendix B.

Sericulture.

17. European silkworms were reared in 1911 for the 8th year in succession. The work was entrusted to U Hir Singh, a passed apprentice of the Rajshahi Sericultural School.* One-fourth oz. of Italian and 1¼ oz. of Var seed were obtained from France in October 1910, and hatched during the first week of April at a temperature of 65°—75°. The worms were fed from the date of hatching to the 3rd moulting 4 times a day and from the 4th moulting to date of spinning 3 times a day. The trays were cleaned every alternate day. The worms throve in the earlier stages, but at the time of spinning many were suffering from grasserie due to the wet weather.

The actual yield of green cocoons was:—

	Md.	srs.	ch.
Italian	2	11	12
Var	1	37	10
Total ...	4	9	6

The green cocoons were killed and dried in a baker's oven at a temperature of 160°—170° F.

The total weight of dry cocoons was 1 md. 16 srs. 8 ch. besides 3½ seers of floss and wastage. The size of the green cocoons and the percentage of shell to weight of cocoon was satisfactory, as will appear from the following table :—

Length in millimetres.	Width, millimetres.	Weight, grammes.	Average weight of shell.	Percentage of shell on weight of green cocoons.
1	2	3	4	5
33·816	16·738	1·62	·2855	17·62

The figures represent the average of 40 green cocoons picked at random.

Seed has been preserved for next year's rearing, and fresh seed has also been ordered from France.

Three Khasi youths, namely, U Hir Singh, Surendra Nath Biswas, and Jay Krishna Kanti have been through a full course of training at Rajshahi Sericultural School and are preparing to take up sericulture on their own account in the Khasi Hills. All three have some land planted with mulberry, but only Jay Krishna Kanti had sufficiently leaf to rear a small quantity of silkworms this year. He was supplied with ¼ oz. of seed and would probably have done well had not the roof of his rearing house at Mahadeo been carried away by a storm. The few cocoons he actually obtained were of good quality and he will make a fresh attempt next year in a stronger house.

Establishment.

18. To obtain more efficient supervision over this Station and the Upper Shillong Farm, the Agricultural Supervisor in charge of the Deputy Director's duties has taken up his headquarters on the Station and the management of the Station has been transferred to the Farm clerk who also resides there. In the absence of the Supervisor the Station is now inspected periodically by the Superintendent of Upper Shillong Farm.

Inspection.

19. The garden was inspected frequently by the Director of Agriculture and the Deputy Director of Agriculture and once by the Reporter on Economic Products to the Government of India.

APPENDIX A.

Statement showing number and species of fruit trees in the Fruit Station.

No.	Species of trees.	Number of trees standing on 30th June.		Number of grafts in nursery on 30th June.	
		1910.	1911.	1910.	1911.
1	2	3	4	5	6
1	Apples	46	42	40	46
2	Pear	199	199	476	426
3	Plum	46	38	.....	53
4	Peach	29	24	1	33
5	Cherry	38	28	.....	2
6	Apricot	9	13	1	19
7	Almond	5	.....	.....	.....
8	Walnut	17	17	.....	.....
9	Fig	44	9	.....	13(a)
10	Grape	127	101	389(a)	60(a)
11	Spanish chestnut	75	77	540 (b)	267(b)
12	Cherimoyer	6	6	.....	1(a
13	Tree tomato	34	16	.....	.....
14	Mountain papaya	6	.....	.....	.....
15	Loquat	3	3	.....	.....
16	Guava	4	4	.....	.....
17	Khasi orange and citron ...	112	112	1	.....
18	Gooseberry	2	1	.....	.....
19	Raspberry	12	22	.....	.....
20	Currant	12	17	.....	.....
21	Nectarine	8	9	.....	.....
22	Quince, common	8	11	.....	.....
	Total	842	749	1,448	919

(a) Rooted cuttings.

(b) Seedlings.

APPENDIX B.

Statement showing the issues of plants and seeds during the year ending 30th June 1911.

No.	Description.	Quantity.	No.	No. of Khasias supplied.	No. of others supplied.	Total.
1	2	3	4	5	6	7
1	Rhubarb roots	.....	33	1	1	2
2	Strawberry suckers ...	.....	25	.....	1	1
3	Asparagus seedlings ...	.....	50	1	.....	1
4	Rhubarb seedlings	.....	23	1	.....	1
5	Pear grafts	.....	4	2	.....	2
6	Mulberry, rooted cuttings ...	.....	220	1	.....	1
7	Fig plan	.....	6	.....	1	1
8	Spanish chestnut seedlings ...	.....	12	.....	1	1
9	Silkworm eggs	½ oz.	.....	1	.....	1
	Total	½ oz.	373	7	4	11

REPORT ON THE UPPER SHILLONG AGRICULTURAL STATION FOR THE YEAR 1910-11.

History and description.

The Upper Shillong Agricultural Station was established in 1897-98. It is situated on the Cherrapunji road 5½ miles from the town of Shillong and occupies the site of the old "Model Farm," which ceased to exist in 1879. The elevation of the Station is 5,900 feet, *i.e.*, about 900 feet higher than Shillong town. A large area of pine forest was annexed to the Station in 1905. The total area of the farm, inclusive of forest, is 336·67 acres. Most of the cultivated land lies on the slope of a long narrow valley, the bottom of which consists for the most part of marshy land covered with a thick growth of wild grass. A considerable area of land has been reclaimed by deepening and straightening the stream which drains the valley and cutting lateral nullahs to connect with it. This work is being continued and extended, but the results of the work already done are very apparent. Soft boggy ground on which previously it was unsafe to walk has been converted into firm pasture land and at the same time the herbage shows a marked change for the better.

The soil of the greater part of the Station is a coarse reddish loam of very loose texture which can be worked with the greatest ease. The sub-soil is of a more pronounced reddish colour and of great depth. In a small portion of the Station the soil is black owing, it is believed, to the existence of some mineral compound. The soils have not been analysed. In point of quality, they are extremely poor, and very little can be grown on them without the help of manure. At the bottom of the valley a different type of soil is found, namely, clay or clayey loam, extremely rich in organic matter. Having been under a thick growth of grass for many years, the upper portion of this soil is a matted mass of half-decayed grass roots. Hitherto this soil has not been brought into cultivation.

Besides the natural poverty of the soil, the greater portion of the Station suffers from the disavantages of an exposed situation. It is colder and more windy than Shillong: frosts are of very common occurrence and more severe than in the town. During the winter the growth of vegetation is entirely suspended.

Purposes of Station.

2. The main objects with which this Station was established were the introduction of superior varieties of potatoes—which are the most important crop grown on the plateau of the Khasi Hills—the breeding of improved strains of cattle suitable for this tract, the cultivation of fodder crops and the ensilage of fodder for use in the winter when green fodder can scarcely be obtained. The same objects are still kept in view. A small area is kept under fruit trees, an account of which is given in the report on the Fruit experiment Station.

Weather.

3. The following table shows the rainfall during the year under report :—

July	1910 ...	36·49	January	1911 ...	1·59
August	„ ...	12·96	February	„ ...	0·10
September	„ ...	10·85	March	„ ...	0·94
October	„ ...	7·28	April	„ ...	7·01
November	„ ...	0·85	May	„ ...	17·35
December	„ ...	*Nil.*	June	„ ...	18·38

There was exceptionally heavy rain in July and October and an almost unbroken succession of rainy days from the middle of April to the end of June.

Summary of work.

4. The work done during the year included :—

Potato experiments.

Trials of clovers and grasses.

Trials of other new crops—oats, flax, New Zealand flax and Chinese soybeans.

Growing fodder crops for silage and hay.

Cattle breeding.

Sheep breeding.

Trials of improved implements.

Demonstrations on cultivators' holdings.

Potato experiments.

5. These were very nearly the same as in the preceding year, *viz.* :—

(i) Variety tests.

(ii) Summer grown *versus* winter grown seed.

(iii) Whole *versus* cut sets.

(iv) Trials of various methods of planting.

Several varieties of potatoes were also grown for distribution as seed.

The spraying and manurial experiments were not repeated, definite conclusions having been obtained as reported last year.

Variety tests.

6. The following eight varieties were tested against each other. The country from which the original stock of "seed" was obtained, and the year in which it was brought to the Farm, are mentioned for each variety :—

Khasi Round—obtained locally in 1900.
Khasi Nainital— ditto.
King Edward VII—England, 1906.
Sutton's Magnum Bonum—England, 1908.
King of Potatoes—England, 1906.
Windsor Castle—England, 1909.
British Queen— ditto.
Up-to date— ditto.

All the varieties were sown in March and harvested in the latter part of July. A uniform weight of seeds, *viz.*, 10 maunds per acre, was used for each variety. Three hundred maunds of cowdung and 10 maunds of oilcake per acre were applied as manure. The plots were sprayed twice with Bordeaux mixture at the rate of 240 gallons per acre. The experiment was made in duplicate, but in the following statement only the average of the duplicate plots is shown for each year.

The statement shows the results of the variety tests for the last four years :—

—	1911.	1910.	1909.	1908.	Average of four years.	Average of last two years.
1	2	3	4	5	6	7
	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.
1. British Queen ...	189 35	92 30	...	...	...	141 12
2. Khasi Nainital ...	157 30	119 0	111 30	292 0	170 5	188 15
3. Windsor Castle ...	181 15	63 15	...	...	...	122 15
4. King of Potatoes ..	201 0	131 20	95 30	319 0	186 30	166 10
5. Khasi Round ...	135 2	95 25	102 25	255 0	147 3	115 13
6. King Edward VII ...	163 13	78 20	90 15	269 0	150 12	120 36
7. Magnum Bonum ...	160 35	132 20	87 30	277 0	164 21	146 27
8. Up-to-date ...	153 0	90 0	...	...	...	121 20

King of Potatoes has uniformly given distinctly the best results. Locally grown seed of the Nainital variety has done as well as Magnum Bonum and better than any of the other imported kinds. The yields obtained during the last three years are very poor, and the results deduced from them are not regarded as conclusive.

The percentage of diseased tubers in each variety was ascertained roughly by cutting open 25 tubers chosen at random. The following are the results obtained in the last 3 years:—

Variety.	Percentage of diseased tubers.		
	1909.	1910.	1911.
1	2	3	4
1. British Queen	nil	12	...
2. Khasi Nainital... ...	10	48	16
3. Windsor Castle ...	nil	16	12
4. King of Potatoes ...	10	12	nil
5. Khasi Round	nil	4	8
6. King Edward VII ...	nil	18	8
7. Magnum Bonum (old stock)	nil	6	4
8. Up-to-date	nil	4	32
9. White City	...	...	8
10. Magnum Bonum (new) ...	...	...	48

The number of tubers examined is too small for a conclusive test; but taking the results as they stand it would appear that though the stock has certainly deteriorated since 1909 the amount of disease in 1911 was generally less than in 1910. Nos. 9 and 10 in the list were new stock imported this year from England for reproduction as "seed." The

amount of disease found in the new Magnum Bohum is astonishing. The only circumstance which goes to explain it is that the "seed" was sown on rather wet soil, but it is possible that even the English growers' stock of Magnum Bonum is losing its former immunity. This variety had always given such excellent results in the past that the failure of this year's new stock is very disappointing. The original intention of importing large quantities of this variety for reproduction as seed will have to be reconsidered and only a small quantity will be brought out next year for a further trial. In point of immunity, the old stock of Magnum Bonum still comes second on the list. King of Potatoes excels all other varieties in this respect as well as in total yield.

Whole *versus* cut sets.

7. This experiment was divided into two parts. In part (1) the same weight of seed, *viz.*, 11 maunds per acre, was used in the contrasted plots. In part (2) the number of sets per acre was made uniform, but the weights differed. The following tables will show the results.

PART (1).

Kind of sets used.	Area tod.	Actual yield.	Yield per acre.	Average yield per acre.
1	2	3	4	5
		Mds. s. ch.	Mds. s. ch.	Mds. s. ch.
First series—				
Cut sets (summer seed) ...	1/40	1 35 0	75 0 0	87 0 0
Ditto	1/40	2 19 0	99 0 0	
Whole sets (summer seed) ...	1/40	1 24 0	64 0 0	98 20 0
Ditto	1/40	3 13 8	133 20 0	
Second series—				
Cut sets (winter seed) ...	1/40	5 37 8	237 20 0	262 0 0
Ditto ...	1/40	7 6 8	286 20 0	
Whole sets (winter seed) ...	1/40	4 32 8	192 20 0	227 0 0
Ditto	1/40	6 21 8	261 20 0	

The variety was "King of Potatoes" sown at the rate of 11 maunds per acre in each case.

The manure applied was :—

(1) Cow-dung ... ... 300 maunds per acre.
(2) Oilcake ... ... 10 " "

PART (2).

Kind of sets used.	Area planted.	Actual yield.	Yield per acre.	Average yield per acre.	Remarks.
1	2	3	4	5	6
		Mds. s. ch.	Mds. s. ch.	Mds. s. ch.	
First series—					
Cut sets (summer seed).	1/40	0 29 0	29 0 0	39 0 0	
Ditto ...	1/40	1 29 0	49 0 0		
Whole sets (summer seed).	1/40	2 15 0	95 0 0	125 20 0	
Ditto ...	1/40	3 36 0	156 0 0		
Second series—					
Cut sets (winter seed)	1/40	5 2 0	202 0 0	211 0 0	
Ditto ...	1/40	5 20 0	220 0 0		
Whole sets (winter seed).	1/40	4 24 0	184 0 0	209 10 0	
Ditto ...	1/40	5 34 8	234 20 0		

The seed rate of whole sets was 10 maunds and for cut sets 5 maunds per acre.

These results indicate very definitely that in the case of winter seed it pays better to use cut sets than whole sets. In this respect the results are in accord with all previous experiments. A new fact which is now being brought out for the first time is that with summer seed whole sets are more profitable than cut sets. The experiment will be repeated.

8. The following statement shows the results of the test in methods of planting :—

Methods of planting.

Method of planting.	Series I.	Series II.	Series III.	Series IV.	Total of 4 series.		Remarks.
	Per plot.	Per plot.	Per plot.	Per plot.	Four plots.	Per acre.	
1	2	3	4	5	6	7	8
	Mds. s.	Mds. s.	Mds. s.	Mds. s.	Mds. s.	Mds. s.	
Local ...	3 35	5 24	4 38	4 24	17 2	170 30	Series I and II were sown with "King of Potatoes", series III and IV with "Magnum Bonum."
Ordinary ...	4 29	3 7	4 26	4 29	17 1	170 15	

The seed rate was 17 maunds 20 seers per acre, the manuring being :—

(1) Cow-dung ... ... 300 maunds per acre.

(2) Oilcake ... ... 10 „ „

The local method of planting potatoes is in flat beds about 7 feet wide with furrows for drainage between every two beds; the tubers are planted in holes 1½ feet apart; manure is placed on the top of the sets and is then covered over with the soil taken out of the holes. Each plant is earthed separately. This method was compared with the ordinary method of planting in drills on the top of the manure and earthing the plants in rows, the field eventually taking the form of alternate ridges and furrows. The results obtained corroborate those of 1909, *viz.*, that usually both methods are equally advantageous. In 1910, however, the local method gave much better results than the ordinary method.

Cultivation of potatoes for seed distribution.

9. From the potato crop of 1910, 172 maunds was issued as "seed," 94½ maunds being sold to applicants in the plains through the Superintendent of the Seed Depôt, and the balance to Khasi cultivators.

In the present year about 225 maunds of seed, tubers of the following varieties, will be available for issue—King of Potatoes, Magnum Bonum (old stock), British Queen, Windsor Castle, King Edward and White City. It is intended to sell the whole quantity to Khasi cultivators for the improvement of their stock. Owing to the large proportion of diseased tubers no seed of Up-to-date, Khasi Nainital, Khasi Round or the new stock of Magnum Bonum will be issued.

Experimental Fodder Crops.

10. (*i*) *Astralagus Sinicus.*—Eight chattaks of seed from the crop of 1909-1910 was sown on the 2nd September 1910, in the Fruit Station on soil heavily manured with cowdung. The seed germinated well and with frequent waterings the crop kept green through the winter. The growth was healthy but stunted, and would produce very little fodder. Seed has been saved again and some of it will be sown this autumn in wet rice land in the same way as Kheshari is often sown in the plains.

(*ii*) *Langtylli.*—About a quarter of an acre planted with Langtylli in 1909 gave two cuttings during 1910, the total yield of fodder being 18¾ maunds. During last winter the land was top-dressed with 125 maunds of cowdung. The growth is now more vigorous than before and it is possible that this crop may prove a useful fodder. An extension of the area planted is now being made.

(*iii*) *Euchlæna Mexicana.*—This crop flowered in February 1910, but set no grain and yielded but little fodder. This year sowing was done earlier in order to give the crop time to mature before the winter.

(*iv*) *Dhaman Grass.*—Very poor results were obtained from this crop last year. Four chattacks of seed was saved and sown in the spring, but failed to germinate.

Ensilage.

11. The following quantities of green fodder were ensiled during the autumn of 1910 :—

	Mds.	srs.
Maize	270	0
Job's tears	133	0
Reisoh	43	20
Wild grass	8	20

The whole of this was put into a masonry silo. The quantity recovered as good silage was 299 maunds 20 seers, *i.e.*, about 66 per cent., which was fed to the farm stock from 21st February to the 22nd April. The total expenditure incurred on silage including cost of cultivation, harvesting, carrying, loading into the silo and chopping was Rs. 213, distributed as follows :—

	Rs.	a.	p.
Maize	72	4	0
Job's tears	35	2	0
Raisoh	27	10	0
Grass	78	0	0
Total	213	0	0

The average cost of silage was therefore about 11 annas per maund. This year an attempt will be made to reduce the loss by wastage by careful packing and by filling the silo to the top ; wild grass will be omitted as being unduly expensive.

New Crops under trial.

12. *Oats.*—One-fifth of an acre was sown in April 1910. The crop made good growth, but owing to rain, little grain was formed and the outturn was poor. The previous autumn sowing also having proved a failure, the trial of this crop has now been discontinued.

Flax.—Two sowings were made in the autumn of 1910, one early in August, the other towards the end of September. In both cases the straw obtained was short in length and the seed was light and worthless. Before abandoning this crop, it is intended to make one more sowing in the present autumn.

New Zealand Flax.—These plants out of a consignment received from New Zealand in 1908 are growing wild in the Fruit Station. It is proposed to separate the roots and plant the suckers.

Soybeans.—Seed of the 10 varieties of Chinese Soybean grown in 1910 was sown this year in small beds. One new variety obtained from Darjeeling has also been sown. At the end of July all the varieties were growing well.

13. The following table shows the number of cattle in the breeding herds on the 30th June 1911 :—

Cattle breeding.

—	Patna.	Bhutia.	Patna + Bhutia.	Patna + Khasi.	Total
1	2	3	4	5	6
Breeding bulls	2	...	...	...	2
Bulls (3 years and above) ...	2	...	...	4	6
Cows	10	3	4	...	17
Heifers	2	...	3	...	5
Young bulls (1 to 3 years) ...	9	...	3	13	25
Bull calves (under one year) ...	3	..	5	...	8
Total	28	3	15	17	63

Eighteen calves were born on the farm during the year ; but there was a heavy mortality among the young stock, especially at Sumer, where 7 heifers and 2 young bulls died. Three Patna cows with two bull calves and one heifer in calf were purchased from Bankipur at a total cost of Rs. 1,050. Unfortunately one cow and the heifer died very soon after their arrival at the Farm. The others are doing well. Eighteen animals comprising 1 Khasi, 1 Bhutia and 8 Patna × Khasi cows, and 4 Patna × Khasi, and 2 Bhutia heifers were sold by auction at the end of the year—the total price realised being Rs. 1,007. One cow bred on the farm realised as much as Rs. 149.

It has been found that without an unduly lavish expenditure on fodder, it is impossible to maintain cattle at Upper Shillong in good condition during the winter, when there is absolutely no grazing to be had. A subsidiary grazing farm was opened last winter at Sumer, about 14 miles from Shillong on the side of the Gauhati road, and most of the farm cattle were kept there from November till March. As is the invariable experience with cattle sent to the low hills, all the animals suffered severely from ticks. Many of them contracted tick-fever and several deaths occurred especially among the young stock. Even after their return to Upper Shillong it took several weeks to free the cattle from ticks. It is expected that having acquired a certain amount of immu-

nity, the cattle will suffer less from ticks in the coming winter. To the ordinary Khasi cultivator, cattle which are not proof against tick are of very little use; it is necessary therefore to continue experiments at Sumer.

A number of three-year old bulls bred on the farm were sold during the year to applicants in the hills. The bull "Tayler" which has sired most of our young stock has now been made over to a cultivator in a village about 7 miles from the farm. No charge has been made for the bull, but the custodian agrees to maintain it in reasonably good condition and to exclude from the village herds all bulls, except some approved by the department. On these conditions the bull is free to serve all the cows, of which there are a large number in this village. The Khasi bulls in the village have now been removed and those that remain are of a good class, including one other Patna bull also supplied by this department to another man in this village on the same terms as "Tayler". Attempts are being made to extend similar operations to another village containing large dairy herds.

Sheep breeding.

14. The experiment started with one Dumba ram and 5 Khasi ewes purchased in February 1909. By the 30th June 1910 the flock had increased to a total of 15 sheep. During the year under report 2 more Dumba rams and 45 Khasi ewes have been purchased and 7 cross-bred rams have been sold. On the 30th June the flock stood as follows :—

Dumba rams.	Khasi ewes.	Dumba × Khasi rams.	Dumba × Khasi ewes.	Khasi ewes. Lambs.
3	52	5	7	2

The cross-bred sheep have much greater weight of flesh than the local stock and the wool is of some value, whilst that of Khasi sheep is worthless. Both Dumbas and cross-breds thrive in the climate of Shillong and are practically free from disease. They seem to be steadily winning their way to popularity.

Introduction of improved implements.

15. A Turn-wrest plough was purchased during the year and used in breaking up new land on the farm. To introduce it among neighbouring cultivators the plough and a pair of bullocks have been hired out at a low charge when they could be spared, and there has been no difficulty in finding applicants.

Receipts and expenditure.

16. The receipts of the year amounted to Rs. 1,753, of which Rs. 609 was obtained by the sale of milk and most of the balance by the sale of cows and heifers. Some money due on the latter account was still outstanding at the end of the year. The expenditure amounted to Rs. 15,132. This included Rs. 2,386 for establishment and Rs. 3,680 for capital charges. These amounts are inclusive of the receipts and expenditure of the *Fruit* Garden, which has hitherto been managed as a joint concern with the Upper Shillong Station.

The gross cost of cattle and sheep beeding alone was Rs. 4,925, made up as follows :—

	Rs.
Cattle food	2,573
Value of farm produce (hay, potatoes, silage, etc. ...	403
Wages of cattlemen	1,600
Miscellaneous	349

The proceeds comprise Rs. 609 from milk and Rs. 1,328 from cattle sold.

ANNUAL REPORT ON THE TROPICAL PLANTATION AT WAHJAIN FOR THE YEAR ENDING THE 30TH JUNE 1911.

History and description.

1. The tropical plantation was started in January 1904. It is situated on the southern slopes of the Khasi Hills and occupies the top and slopes of a ridge about 1,200 feet above the sea level. The site of the plantation was selected by Rai B. C. Basu Bahadur. It is close to the Cherrapunji-Theria bridle path and about seven miles below Cherrapunji.

The plantation was opened under the orders of Sir Bampfylde Fuller with the idea of experimentally introducing certain of the tropical products of Ceylon and Madras. Mr. Basu was deputed by Government in the autumn of 1903 to Madras and Ceylon to study the cultivation of these products and to procure seeds and plants. Various tropical fruit-trees, new to the Khasi Hills, were procured for trial, most of them being obtained from the Royal Botanical Garden at Peradeniya in Ceylon and from Madras. The plantation also contains a small area planted with coffee, which has been introduced by private enterprise into the Khasi Hills, and a large number of the more common economic plants of the country, such as oranges, different species of citrus, betel-nut, pân and black-pepper.

The plantation has an area of 53·54 acres. The whole was under forest at the time of acquisition. The first operation was to mark out a number of fields and to remove the forest by felling and burning. In two fields the forests has not been wholly removed; the larger trees having been retained for shade and the ground underneath cleared of undergrowth. These two fields are intended for growing such plants as are unable to stand full exposure to the sun. Up to the close of the year under report 14·50 acres have been planted. This area is divided into six fields, the lowest of which is 600 feet below the top of the ridge.

Soil.

2. Over the greater part of the plantation the soil consists of a shallow, loose loam, dark on the surface due to admixture of organic matter, but yellow underneath. In many places it is mixed with gravel, with occasional sandy patches. All over the surface boulders protrude. These consist chiefly of sandstone,

but out-crops of limestone also occur. The boulders to a certain extent prevent the soil from being washed away by the annual heavy rains which fall on these slopes, but in spite of this there is a considerable wash of soil down the slopes every year, and this is accelerated as more jungle is cleared.

Two samples of soil from the plantation have been analysed by Dr. Leather, with the following results :—

—	No. 1.	No. 2.
1	2	3
Per 100 *parts of whole soil.*		
Stones	3·62	17·48
Fine earth	96·38	82·52
	100·00	100·00
Per 100 *parts of fine earth.*		
Insoluble silicates and sand ...	72·63	78·43
Ferric oxide	5·43	2·86
Alumina	10·85	11·20
Manganous oxide	0·09	0·03
Lime	1·06	0·15
Magnesia	0·58	0 41
Potash	1·74	1·97
Soda	0·10	...
Phosphoric acid	0·05	0·02
Sulphuric acid	0·06	0·01
Carbonic acid	0·07	0·05
Organic matter and combined water	7·34	4·87
	100·00	100·00
Nitrogen	0·15	0·05
Available P^2O^5	0·0015	0·0004
„ K O	0·009	0·008

Dr. Leather reported as follows on the two samples .—

"No. 1 contains a fair amount of organic matter and nitrogen and a large amount of potash (total), but the amounts of carbonate of lime and readily available phosphates and potash are decidedly small. No. 2 is a quite different soil. It is white and contains comparatively little

iron, with a high proportion of alumina. Of the chief plant foods it contains only very little, and should respond well to any complete manure".

Sample No. 2 represents the main class of soil found on the plantation.

Climate.

3. Wahjain lies a short distance below the plateau of Cherrapunji, which holds the world's record for rainfall. During the spring and early summer (March to May), the weather is characterised by high winds and frequent thunderstorms, with heavy bursts of rain, which bring on a quick growth of vegetation. The monsoon follows with rainfall not much less than that of Cherrapunji itself, and is succeeded about the middle or end of October by calm and almost rainless weather, which continues through the winter till about the middle of March.

There is too much rain during eight months of the year and practically none for a continuous period of four months. Herein the climate of Wahjain differs from that of Ceylon and other tropical countries where such long periods of drought are unknown. The absence of rain has been found particularly trying to such essentially tropical plants as the nutmeg and clove, the latter of which has died out. It is also possible that the winter temperatures of Wahjain are too low to suit such plants. The lowest recorded temperature in the shade was 43°F. in February 1905 and the highest 90°F. in May 1908.

Character of the season.

4. The rainfall on the plantation from July 1910 to June 1911 was as follows :—

Month.	Rainfall.	Number of rainy days.
1	2	3
	Inches.	
1910, July	181·80	29
,, August	68·19	25
,, September	29·04	16
,, October	11·53	14

Month.	Rainfall.	Number of rainy days.
1	2	3
	Inches.	
1910, November	3·35	2
„ December	Nil	Nil
1911, January	4·44	4
„ February	2·12	3
„ March	15·49	9
„ April	33·74	18
„ May	52·39	25
„ June	65·09	24
Total for the year ...	407·18	169

This season has been characterised by very heavy rain during the summer months and the total is 141·42 inches over the total of the previous year. The highest temperatures recorded during the year were 86° in the months of July and September and the lowest 52° in the month of January.

5. The following are the chief items of work carried out during the year :—

Work done during the year.

Pruning.—In December, with the exception of the coffee plants, the same trees were pruned as in last year, *viz.*, ketembellas, sapotas, soursops, cashew nuts, citrus fruits, oranges, mangoes, lichees, cocoa and rambutan. It was thought desirable to leave the coffee plants unpruned this year.

Manuring.—In February all the trees in the plantation, except local oranges and limes, camphor, cardamoms and cinnamons, were manured with cowdung, leaf-mould and oil-cake, and in June 2 lbs. of fish manure was also applied to each of the coffee plants in bearing. As in previous years, the cocoa and coffee plants (except under shade) were mulched with the refuse from the distillation of lemon-grass, in the month of February.

Lemon-grass.—Four cuttings and distillations of lemon-grass have been made. The first (Cochin, Tyrna, Moriani and Ceylon grass) started on August 1st 1910 and continued till October 7th; the second (Cochin grass) lasted from October 8th to October 25th; the third (Tyrna, Moriani and Ceylon) from February 13th to March 8th; and the fourth (Tyrna, Moriani, Ceylon and Cochin) from March 27th to April 7th.

The following table shows the amount of grass cut and the oil obtained in fluid ounces :—

—	Amount of grass.	Oil, fluid ozs.	Oil, fluid ozs. per maund of grass.
1	2	3	4
First distillation—			
Cochin	16	40	2·5
Tyrna	31	93	3
Moriani	9	36	4
Ceylon	4	16	4
Second distillation—			
Cochin	29	72	2·48
Third distillation—			
Tyrna	21	66	3 14
Moriani	6	24	4
Ceylon	8	36	4·5
Fourth distillation—			
Tyrna	12	38	3·16
Moriani	3	12	4
Ceylon	4	18	4·50
Cochin	9	22	2·44
Total	152	473	...

The figures for this year bear out those for last year with regard to the quantity of oil produced per maund of grass by the different varieties. The Ceylon and Moriani grasses continue to produce the largest quantity of oil, while the Cochin grass produces the smallest.

In October 1910, 200 ozs. (Tyrna 80 ozs., Cochin 60 ozs., Moriani 40 ozs. and Ceylon 20 ozs.) were sent to the Imperial Institute, South Kensington, for analysis and valuation. The citral percentage (by the sodium bisulphite

method) of the various oils was found to be—Tyrna 72·5, Cochin 84·5, Moriani 73, Ceylon 76. As regards solubility in alcohol, only the Cochin grass was found to be soluble in 70 per cent. alcohol. The Director, Imperial Institute, reports "these four oils all contained a satisfactory amount of citral, but the 'Cochin' oil is particularly rich in this constituent, containing 84·5 per cent. Most lemon-grass oils of commerce contain from 70 to 75 per cent. of citral. If therefore the 'Cochin' grass grows well and gives a good yield of leaves, it will be desirable to encourage its cultivation rather than that of the other varieties."

The Tyrna, Moriani and Ceylon oils were sold at $2\frac{3}{4}d.$ per oz. and the Cochin at $3\frac{1}{2}d.$ per oz.

The area under lemon-grass remains the same as last year, *viz.*, 4·12 acres.

Camphor.—The camphor trees have now reached a stage fit for cutting for distillation and experiments were started in May of the present year. A small still, modelled on those in use in Ceylon, has been constructed at a cost of Rs. 80. In the first trial distillation 35 lbs. of twigs and leaves yielded $1\frac{3}{4}$ ozs. of crude camphor. The experiments are still being carried on but further figures are not yet available.

Experiments in propagating the camphor trees by root-cuttings and layerings have also been started. Out of 30 root-cuttings put down at the commencement of the rains, 20 have succeeded and out of 50 layers, 10 have proved successful.

Oranges and citrus varieties.—The chief work in connection with citrus fruits has been the raising of seedlings of various citrus varieties for further budding experiments. During the year 330 seedlings of five different varieties have been raised and there are now on the plantation over 800 seedlings of eight different varieties (excluding oranges) which will soon be available for budding experiments. The budding experiments up to date have not proved very successful. This rains only 19 buds on soh-sying stocks (a local variety of citron) and 3 buds on soh-myndong stocks (a local lime) have succeeded out of a large number.

The citrus varieties planted at Umlong in 1907 are still thriving and show no sign of disease. From reports by local Khasis, it would appear that the orange disease is abating.

6. The expenditure on the plantation for the year has amounted to Rs. 1,769-4-1, including establishment, repair of the malis' and servants' quarters and the cost of the apparatus for distilling camphor. The receipts for the year amount to Rs. 139-13-4.

Expenditure.

7. The plantation has been inspected once by the Deputy Commissioner, Khasi and Jaintia Hills, the first Deputy Director of Agriculture, the Reporter on Economic Products to the Government of India and by the Economic Botanist.

Inspection.

DACCA ;
The 7th July 1911.

G. P. HECTOR,
Economic Botanist, Eastern Bengal and Assam.

E.B. & A. S. P. O. (Agri.) No. 18—770—21-2-1912.

00132931

Digitized with financial assistance from
Government of Maharashtra
on 01 February, 2020